American Machinist

Volume 56 NEW YORK, MAY 18, 1922 Number 20

Shall We Standardize Machine Tools?

The Dangers of Promiscuous Standardization — What Real Standardization Means and How a Start Can Be Made—Good Standards Available

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FOR the last fifteen or sixteen years the builders of machine tools have been discussing the merits of standardizing some of the parts of machine tools. Everybody agrees that something ought to be done about it and that it would be a good thing for the industry and for each individual. Then a committee is appointed and the matter is forgotten. So far none of the committees has committed anything more serious than time-slaughter and not much of that, probably because they took a good look at all the things that ought to be done and couldn't decide just where to start.

They had to buck the splendid conservatism of the dollars-and-cents men at the head of the different companies, too. And no wonder there was opposition to standardization, as it was, and still is understood by a good many people. I haven't a doubt that a lot of the machine tool builders thought the standardization scheme was going to be something like the one that was put up to me during the war by one of the younger "experts" of one of the government departments. This fellow blew into my office one day and said he wanted the names of all the companies in the country that made "laths" and "planners." It was a couple of minutes before I gathered what he meant, but when it finally percolated I managed to keep my face straight and ask him what he wanted them for.

"LATHS" AND "PLANNERS"

Well, it seems he was going to standardize all the "laths" and "planners" so that everybody who made them would produce just one kind and the parts made by one fellow would be interchangeable with those made by every one else. Then we would have real quantity production and lathes would roll out of the shops as the universal cars roll out of Henry Ford's factory. When I asked him if he was going to use the same kind of lathe for turning shells that he used for spinning he seemed a bit disturbed for he evidently thought that a "lath" was a "lath" and that was all there was to it.

Of course this incident is only an example to show how standardization can be reduced to an absurdity, but it does bring out the danger in putting standards work in any but the most expert hands.

Another impression that must be overcome is that the adoption of a standard means that everything which does not conform to the standard must immediately be scrapped. Of course this isn't so. Take the experience of the Society of Automotive Engineers. They have probably done more work along these lines than anybody else and established more standards. I think I am right in saying that not a single one of their standards was actually used in the first year after its adoption by the society.

Manufacturers cannot afford as a rule, to scrap parts or machines already in production because they do not conform to some particular standard. But when changes in design are made, as they must be periodically in order to keep up with the procession, it is easier to make use of an existing standard than it is to take the trouble to design something different. In the course of time everybody has to make changes and before long they all wonder how they ever got along when every designer had a slightly different way of making the same piece.

ONE WAY INSTEAD OF FORTY-SEVEN VARIETIES

As far as the machine tool builders are concerned there are two ways to go at the standardization question, or perhaps it would sit easier if we said "simplification" for that is what it amounts to in the long run. In the first place there are many parts of any machine tool which might just as well be made in just one way instead of forty-seven different ways, differing from each other in non-essential particulars only. The individuality of the designer or of the machine could still find plenty of places and ways to express itself.

Take T-slots, we might just as well decide on enough standard sizes and proportions to take care of any possible requirement and then use them the next time we bring out a new model. The same thing might be done with spindle noses and handles and other inconsequential parts that are more or less alike anyhow. Something could certainly be done about tapers.

Even in these simple things there is room for lots of argument so perhaps it might be better to start out along the other track. There are any number of perfectly good standards already in existence and in common use. There are undoubtedly some of the S. A. E. and A. S. T. M. standards that could be adopted bodily without much effort on the part of anybody. There are ball-bearing standards and specifications for steels and alloys and bearing metals that could be used just as well in machine tools as in automobiles. The National Screw Thread Commission has some excellent recommendations on fits and tolerances in threads and the American Gear Manufacturers' Association is making strides with gears. Getting proved and workable standards in this way would be just as easy as collecting a ready-made family by visiting the orphan asylums and adopting good-looking orphans with satisfactory pedigrees.

As I said before, persuading the industry to accept any kind of a standard isn't going to be an easy job. It

is not so many years ago that one of our most progressive makers of milling machines called me several particularized kinds of a fool for telling him that he would use hardened steel gears and other parts in his machine before he got much further. He's advertising them now.

What is to be gained by standardizing, or simplifying? Well, here's one instance: I know of a company that makes machines for cutting gears. They naturally use gears in their machines and they have been cutting the gears in their own shop on their own machines. Some idiot asked them not so long ago if they could buy their gears cheaper than they could make them as they were making them in relatively small lots. He was laughed out of the office but he made an impression, for they were curious enough to inquire of one of the big gear shops what their gears would cost. To make a long story short, they found that they could buy these gears, cut on their own machines in the gear shop, at about half what they could make them for in their own shop. Is it necessary to go any further?

Now, let me repeat what I said in the beginning. What is needed is a committee that will commit something definite. It should be made up of some men with vision who can grasp the possibilities of simplification and also some of the old reliable hard heads who will keep the visionaries from attempting too much at first and at the same time insist on pushing through the standards that are found to be feasible and worth while.

Rewards for Suggestions—Discussion

BY OSCAR E. PERRIGO

On page 448, Vol. 55, of AMERICAN MACHINIST, C. J. Morrison makes some timely and very practical remarks on the subject of "Rewards for Suggestions." His ideas are perfectly correct, in that it requires a very wise management to formulate an equitable system for the examination of and the reward for suggestions, so as always to be fair to the suggestor as well as to the management.

There are a number of good and practical reasons for this condition. Suggestions thoughtfully and honestly made, with a view to the improvement of some general or special condition existing in the plant, or in some of its equipment, are sometimes of no possible value in any form. Sometimes a slight change in the suggestion may render it of considerable value. Again, the germ of thought contained in a suggestion may, when properly developed, form the basis of a good and valuable patent.

The person making the suggestion should always be allowed to be present when his suggestion is to be acted upon, and frequently a few words from him will dissipate a misunderstanding. Besides, we should not forget that: "Every American citizen has the undoubted right to be heard in any cause in which he has a personal interest." Yet many of these cases are decided on ex-parte testimony. That is a reason why men sometimes feel "sore," and think that they have been denied their rights. It is an old shop maxim that "there is no profit in a sore man."

The method of judging the value of suggestions, and of making the payments is a much more important matter than is generally considered. Since some suggestions which seem valuable and are paid for as such are finally found to be useless, while others are paid a nominal sum and afterwards found to be very valuable, suggests a system which will be equitable to all concerned.

The plan is this: Instruct a committee to be liberal in its judgment of the value of suggestions. If there is a doubt as to the practicability and value of a suggestion, give it the benefit of the doubt. Then pay a nominal reward for all suggestions passed upon as favorable. At the end of six months, if no additional value seems to have accrued upon a certain suggestion, let it lay for another six months. If no special value is seen at that time, it is dropped and no further account is kept of it. But, if at the end of six months the suggestion has proved of value, repeat the original payment; and if similar advantage is seen at the end of another six months, repeat the payment again. If, at the end of the second six months, the suggestion has proved of especial value, a final payment of its real worth to the plant is estimated and paid.

The first important feature of this plan is that suggestions of special merit will receive special reward; while, secondly, employees are much more likely to present suggestions for permanent or continued benefit rather than those of temporary or transient value. The aggregate amount which the management feels should be devoted to this purpose can be so divided that the annual expense will be no more than by the usual method, while the good influence which the system exerts among the employees will be greatly enhanced.

ACCEPTING SUGGESTIONS

As an illustration of how easy it is to make mistakes in judgment as to the value of suggestions, the following incidents well known to the writer are given. Quite a number of years ago a draftsman was employed to design a certain precision machine, the requirements for which were very rigid. The machine was designed in somewhat less time than the management had expected, and was built under the direction of the designer. Upon the first test it was apparent that changes in the material of some of the parts would be advisable. These changes were made, and upon the final test before the management, the machine was pronounced a success, and several others were ordered to be built. Within a week the designer was made superintendent of the plant.

A number of years after, this same man was employed in a plant where an elaborate suggestion system was in force, and a committee of supposedly technical experts had been appointed to examine the suggestions presented. A certain machine built by the company required as a part of its design a device producing a similar effect to that on the machine which the man had designed years before, so that he now filed a suggestion covering a sketch of the necessary parts. It was examined by the committee, which declared that the principle was wrong and that such a device would be inoperative.

A rather ludicrous sequel to the matter was that a year or so after the above event, this same company purchased a very high-priced and elaborate precision machine in which the very principle that had been rejected was used upon one of its most important precision parts, and was working precisely as it had worked on the machine which had earned this designer a superintendent's position. These happenings naturally lead to the conclusion that it is a man very certain of his ground who undertakes to say that a certain device will not work, lest some man who does not know nearly as much as he should make it work. The time-honored question of "who shall decide when doctors disagree," is not confined to the medical profession.

Methods of Machine Tool Design

Third Article—Machine Tool Drives Analyzed—Why the Drive Problem Is More Difficult for Machine Tools than for Other Machines

By A. L. DeLEEUW

THE drives of many classes of machines consist merely of the simplest kind of power transmission, such as two pulleys and a belt or a couple of sprockets and a chain. As a rule only one speed is required and in the majority of cases the maximum load is well known. Conditions are entirely different with most machine tools. The maximum load is not definitely known and is only guessed at. Very frequently a number of speeds are required and the range of these speeds is much in excess of the range of variable speeds found in any other class of machines. In addition, these speeds must be readily obtained by the operator if they shall be of any use at all.

In fact, there is no other class of machines which combines all of these requirements. A spinning machine does require variable speeds, but over a very small range and requiring little power. An automobile also requires variable speeds, but again over a very limited range and only very few speeds. A machine tool, on the other hand, may require anything between 100 hp. or a fraction of 1 hp. and many machine tools are constructed with as many as thirty, and sometimes even more speeds, all mechanically controlled. It is perfectly true that, as a rule, the user of the machine tool does not require all the speeds furnished, but as the maker of the machine cannot know which speeds might be required by the various users, he is compelled to furnish all useful speeds and bring them close enough together so that whatever the job may be there will always be some speed which is nearly correct for that particular case.

Selecting Speeds

If we had a large boring mill to be used exclusively for the turning and boring of large flywheels, we would require a number of speeds which would make this machine as economical as possible for the turning and facing of the rim and then a few other speeds which would make it as economical as possible for the boring and facing of the hub. For instance, we might have speeds of 1—1.1—1.2—up to 2 r.p.m. for the rim; and 10—11—12—up to 20 r.p.m. for the hub, and this would be perhaps the best arrangement possible if nothing else ever had to be turned up on this boring mill but large flywheels. If a concern should build a special machine for this purpose it would probably arrange the speeds in some such fashion; but in doing so it would make of the machine a special machine in every sense of the word. It would have to be rearranged as soon as different kinds of work were assigned to it. The builder of standard or commercial machine tools is confronted with the problem of selecting speeds which will make the machine as economical as it is possible to make it for any job within its range.

In practically all cases the various speeds of a machine tool are arranged in geometrical progression. It was quite customary to advertise this feature as a special merit of some machine, and even now we may find occasionally an advertisement mentioning the geometrical progression as a special feature of high value and peculiar to the advertised machine; but this only occurs nowadays when the advertiser honestly believes the public to be as ignorant as he himself. We realize at the present time that the geometrical progression of the speeds of a machine tool is the best all-around *compromise*. We know full well that it does not give us the exact speeds we desire, but that no other standardized arrangement would bring us so near to the speed we need under all conditions of size and material of work.

To illustrate this a little further let us take for example a 24-in. lathe made by a well-known machine tool builder. The speeds are twelve in number and range from 8.1 to 315. These speeds, being in geometrical progression, would be 8.10—11.30—15.76—22.00—30.7—42.8—59.6—83.2—116.0—161.8—226—315.

This lathe swings 19¾ in. over the carriage, so that if we have a piece in the machine of a diameter equal to the full swing over carriage, and we should run 8.1 r.p.m., we would have a cutting speed of only 42 ft. Now, there are very few occasions indeed where a piece of the full swing of the lathe and at the same time of a very hard material would have to be turned up, so that we may say that the lower speeds of this lathe are emergency speeds and it would perhaps be perfectly satisfactory if only one of these low speeds were provided. However, the various series or groups of speeds are obtained by the shifting of a pair of gears or the throwing in of a clutch, so that the general nature of a group is reproduced but at a higher speed.

If in this particular case we should leave out the second and third speed so that the first speed would be 8.1 and the second 22, then if we should shift so as to get the next series of speeds beginning with, say, 59.6, the second speed of that series would be 161.8. Now these speeds of 59.6, etc., are used on the great majority of the work done on this machine and it would not be permissible at all to have as great a gap between the speeds as that of 59.6 and 161.8. The necessity of having speeds fairly close together in the higher ranges compels us to bring them fairly close together in the lower ranges also, though we may not need them there. In some other machine we may need the lower speeds close together and this would compel us to furnish a number of high speeds also, though we can get along without them.

Calculations for Geometric Progressions

The following calculations in regard to the speeds of a machine tool also apply to the feeds. In general, they apply to any mechanism in which we wish to have a series of speeds in geometrical progression.

The various drives of machine tools can be divided into two classes. In the first class the first driving element of the machine has a constant speed. In the second class it has an adjustable speed. Machines of the first class are generally called "constant speed" or "single pulley" machines. All the speed changes are

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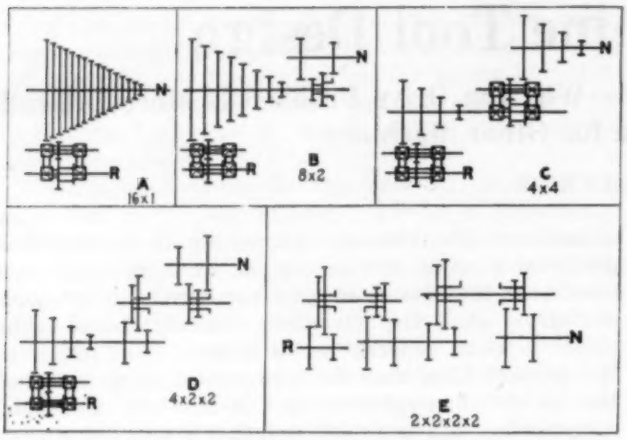


FIG. 16. DIAGRAMS OF 16-SPEED SHIFTS

made by means of the mechanism of the machine itself. In the second class part of the changes, and sometimes all, are made by mechanism of which part is outside of the machine proper, such as a countershaft with cone pulley, or a variable speed countershaft, or an adjustable speed motor.

For the present we will confine ourselves to speeds arranged in geometrical progression. If all speeds are obtained by means of one single system of machine elements, such as, for instance, a number of steps on a cone pulley or a number of gears all served by one tumbler gear, we will say that we have a single shift arrangement. If such a shift is exhausted and we bring into play some other group of elements we will get a two-shift arrangement, etc. The number of shifts possible depends on the number of factors of the numeral indicating the number of speeds. For intsance, with sixteen speeds we would reason thus: We can consider sixteen as 16 x 1, or as 8 x 2, or as 4 x 2 x 2, or as 4 x 4, or as 2 x 2 x 2 x 2. The first would correspond to a cone pulley with sixteen steps (which, by the way, is not likely to be used). In the second arrangement we would have two factors and therefore two shifts; in the third arrangement, 4 x 2 x 2, we have three factors and therefore three shifts, while in the fourth arrangement, 4 x 4, we again have two shifts, and in the last arrangement, 2 x 2 x 2 x 2, we have four shifts.

With eighteen speeds we would have the following: 18, or 2 x 9, or 3 x 6, or 2 x 3 x 3, which will give us respectively 1—2—2—3 shifts. With twenty speeds we would have 20, or 2 x 10, or 4 x 5, or 2 x 2 x 5, which would give us in the same order 1—2—2—3 shifts.

Such arrangements are shown in Fig. 16 in diagrammatic form. Each arrangement consists of as many speed variators as there are shifts, and each individual speed variator is represented as a cone of gears with the well-known tumbler gear and idler, or sometimes as a set of sliding gears.

In Fig. 16-A-B-C-D and E are given the various possible shifts for sixteen speeds. Fig. 16-A shows a cone of sixteen gears or a cone pulley with sixteen steps or maybe sixteen steps of an adjustable speed motor. Fig. 16-B shows a combination of two speed variators, one with eight and one with two steps. Fig. 16-C also has two shifts. This time each one for a speed variator of four steps. Fig. 16-D shows three shifts, one for a speed variator of four steps and two for speed variators of two steps each. Finally, Fig. 16-E shows a four shift variator, each of the two elements being a two step variator. Fig. 17 shows the possible combinations for eighteen speeds and Fig. 18 for twenty speeds.

It should be thoroughly understood that the diagrams do not show the construction of speed changing mechanisms, but merely the way they can be split up into their elements. They do not even show the proper order of these elements; for instance, in Fig. 17-H the six step variator comes first and the three step afterward. This order may be reversed. Which one would be the best sequence would depend on circumstances.

We have shown these various arrangements as all-gear drives, because it simplifies the diagrams. However, some of the groups or variators shown might be adjustable speed motors or belt constructions. There are many arrangements in existence in which the first group or speed variator is replaced by an adjustable speed motor, but, whenever such a motor is used, it will be found as the beginning of the arrangement. One

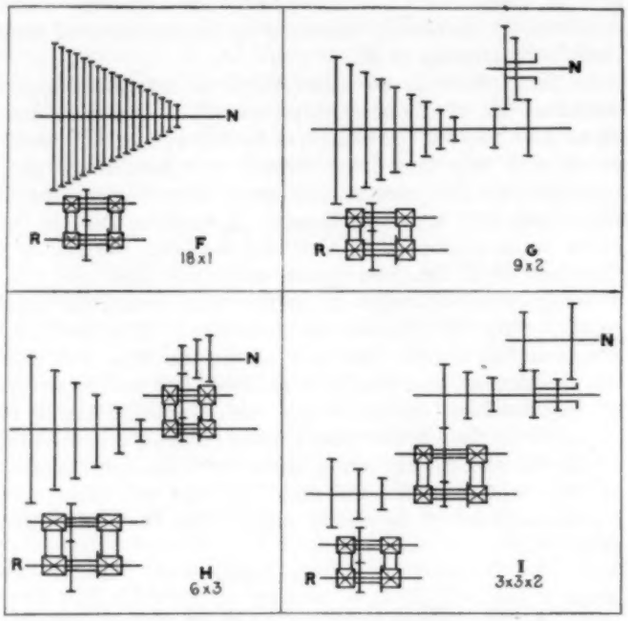


FIG. 17. DIAGRAMS OF 18-SPEED SHIFTS

does not find it as a substitute for the second, third or fourth group. On the other hand, belt drives lend themselves to many variations and groupings.

In Fig. 19 a partial schedule is given of the possible arrangements of machine tool drives. They are divided into two groups, one for constant speed motor or pulley and one in which adjustable speed motors or cone pulleys are used. As we are not really concerned with the adjustable speed motor the diagram proceeds without regard for this element, considering only various belt drives. No effort is made to show the various kinds of constant speed drives because they have been considered in the previous paragraphs. The belt drives are again divided into two groups, in one of which all variations of speeds are made by belt while the other makes its variations by means of belts and gears. This diagram does not show all the possible combinations of belts and gears because they are unlimited in number. It does show, however, a number of the most common constructions used in machine tool drives.

When there are two countershaft speeds they may be arranged either so that a shift from one countershaft speed to the other splits up the variation between two adjoining cone speeds, or else they may be arranged

in such a way that after all the cone speeds are exhausted one makes a shift to the next countershaft speed and begins again with the first cone step.

A few of the arrangements of the above diagram have been further analyzed. They are marked as Case 1-A, Case 1-B, Case 2, 3, 4 and 5. The numerals refer to corresponding numerals in Fig. 19. Cases 1-A and 1-B differ only in so far that in Case 1-A the two cones are supposed to have the same steps as is customary in most machine constructions; while in Case 1-B these cones are not alike. This latter case is not very common. However, it is used where the machine must have speeds very much in excess of the countershaft speeds. The countershaft being a machine unit which depends for its alignment on ceilings and beams and such like is not very well adapted to be run at a very high speed; so that it is advisable to do some speeding up between countershaft and machine, if the machine must run at a high speed. In such cases we will find the countershaft cone different from the machine cone.

The following calculations show a method of obtaining the main elements of the various arrangements indicated in Fig. 19. As all of it may not be quite clear in

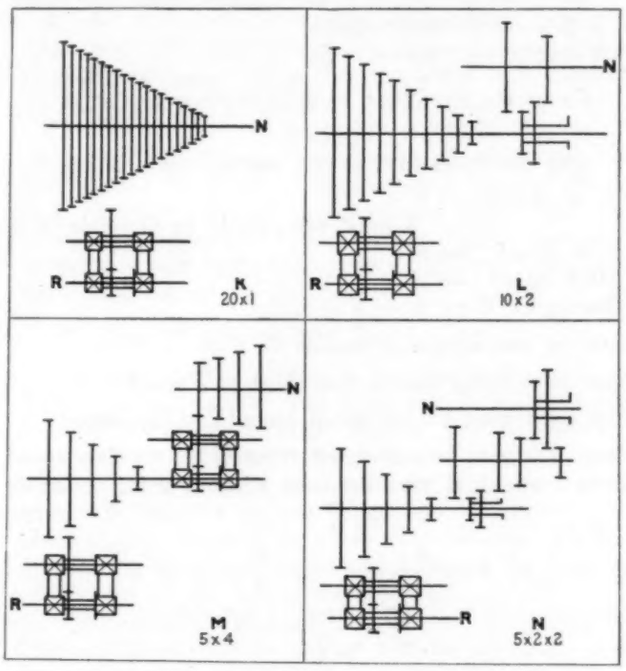


FIG. 18. DIAGRAMS OF 20-SPEED SHIFTS

the mind of the reader at the first reading, we will go over one example, Case 1-A. The number of speeds is given as n, the low speed as s, and the high speed as S. As these speeds are supposed to be in geometrical progression they are:

$$a \text{——} ar \text{——} ar^2 \text{——} ar^3 \text{——} \smile \text{——} ar^{n-1}.$$

The range R is the highest speed divided by the lowest which is $\frac{S}{s}$; so that $\frac{S}{s} = r^{n-1}$ and $r = \sqrt[n-1]{\frac{S}{s}} = \sqrt[n-1]{R}$.

The countershaft speed C can be expressed as the largest step of the lower cone divided by the smallest step of the upper cone times the low speed; and we might also express it as the smallest step of the lower cone divided by the largest step of the upper cone times the high speed. This shows us that the countershaft speed equals the square root of the product of high and low speeds.

The accompanying calculation shows so clearly how to find one extreme step of the cone when the other one is given that it is not necessary to go further into this matter. What is not so plain is how to find the next step. In the accompanying calculation the next steps to be calculated are called x and y, and the sum of x and y is supposed to be the same as the sum of d and D which, as we know, is customary. We find, therefore, that step y equals d plus D minus x. Keeping this in mind it will be easy to follow the rest of the calculations.

CASE 1-A

WHEN THE TWO CONES ARE ALIKE

No. of speeds $= n$
Low speed $= s$
High speed $= S$
Range $= R = S \div s$

$$\text{Ratio of two adjoining speeds} = r = \sqrt[n-1]{R}$$

$$\text{Countershaft speed} = C = \frac{D}{d} \times s = \frac{d}{D} \times S$$

$$\frac{D^2}{d^2} = \frac{S}{s}$$

$$\frac{D}{d} = \sqrt{\frac{S}{s}}$$

$$C = \sqrt{\frac{S}{s}} \times s = \sqrt{Ss}$$

If small step $= d$ diameter

$$\text{Large step} = D = d\sqrt{\frac{S}{s}}$$

$$\text{Step } y = D + d - x$$

$$C \times \frac{D + d - x}{x} = s \times r$$

$$\sqrt{Ss} \times \frac{D + d - x}{x} = s \times r$$

$$\frac{D + d - x}{x} = \frac{sr}{\sqrt{Ss}} = \frac{r\sqrt{Ss}}{S}$$

$$D + d - x = \frac{r\sqrt{Ss}}{S} \times x$$

$$D + d = x\left(\frac{r\sqrt{Ss}}{S} + 1\right)$$

$$x = \frac{D + d}{\frac{r\sqrt{Ss}}{S} + 1}$$

$$y = D + d - x$$

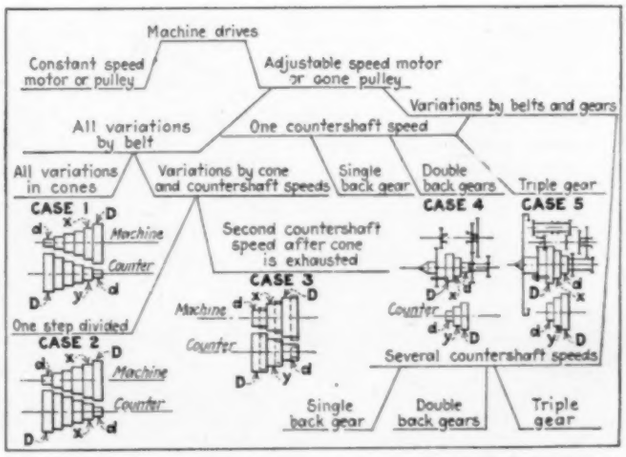


FIG. 19. SCHEDULE OF POSSIBLE DRIVE ARRANGEMENTS

CASE 1-B

WHEN THE TWO CONES ARE NOT ALIKE

No. of speeds $= n$
Low speed $= s$
High speed $= S$
Range $= R = S \div s$

Ratio of two adjoining speeds $= r = \sqrt[n-1]{R}$

Countershaft speed $= C = \frac{D}{d} \times s$

Step $y = D + d - x$

$$C \times \frac{D + d - x}{x} = s \times r$$

$$\frac{D}{d} \times s \times \frac{D + d - x}{x} = s \times r$$

$$\frac{D}{d} \times \frac{D + d - x}{x} = r$$

$$\frac{D^2 + Dd - Dx}{dx} = r$$

$$D^2 + Dd - Dx = rdx$$

$$D^2 + Dd = (rd + D)x$$

$$x = \frac{D^2 + Dd}{rd + D} = \frac{D(D + d)}{rd + D}$$

$$y = D + d - x$$

CASE 2

WHEN THE TWO CONES ARE ALIKE

No. of speeds $= n$
Low speed $= s$
High speed $= S$
Range $= R = S \div s$

Ratio of two countershaft speeds $= r = \sqrt[n-1]{R}$

Ratio of two adjoining pulley speeds $= r^2 = \sqrt[n-1]{R^2}$

Fast countershaft speed $= C_F = \frac{D}{d} \times rs = \frac{d}{D} \times S$

$$\frac{D^2}{d^2} = \frac{S}{rs} \qquad \frac{D}{d} = \sqrt{\frac{S}{rs}}$$

$$C_F = \frac{D}{d} \times rs = rs\sqrt{\frac{S}{rs}} = \sqrt{rSs}$$

$$C_S = \frac{\sqrt{rSs}}{r} = \sqrt{\frac{Ss}{r}}$$

If small step $= d$ diameter

Large step $= D$, $\frac{D}{d} = \sqrt{\frac{S}{rs}}$. $D = d\sqrt{\frac{S}{rs}}$

Step $y = D + d - x$

Third speed is obtained with belt on x and y and with slow countershaft speed.

$$sr^3 = \frac{y}{x} \times C_S = \frac{D + d - x}{x} \times \sqrt{\frac{Ss}{r}}$$

$$sr^3 \times x = (D + d - x)\sqrt{\frac{Ss}{r}}$$

$$sr^3 x + x\sqrt{\frac{Ss}{r}} = (D + d)\sqrt{\frac{Ss}{r}}$$

$$x = \frac{(D + d)\sqrt{\frac{Ss}{r}}}{1 + \sqrt{\frac{Ss}{r}}} = \frac{(D + d)\sqrt{rSs}}{r + \sqrt{rSs}} = \frac{(D + d)C_F}{r + C_F}$$

$$y = D + d - x$$

CASE 3

WHEN THE TWO CONES ARE ALIKE

No. of speeds $= n$
Low speed $= s$
High speed $= S$
Range $= R = S \div s$

Ratio of two adjoining speeds $= r = \sqrt[n-1]{R}$
Slow countershaft speed $= C_S$

Slow countershaft speed brings speed up to step $\frac{n}{2}$

Fastest speed of machine cone, using slow countershaft is $s \times r^{\frac{n}{2}-1}$

$$C_s = \frac{D}{d} \times s = \frac{d}{D} \times sr^{\frac{n}{2}-1}$$

$$\frac{D^2}{d^2} = r^{\frac{n}{2}-1}$$

$$\frac{D}{d} = \sqrt{r^{\frac{n}{2}-1}} = r^{\frac{n-2}{4}}$$

$C_s = s \times r^{\frac{n-2}{4}}$

To find x and y follow Case 1-A, substituting $s \times r^{\frac{n-2}{4}}$ for S (as this speed is the highest obtainable speed with this countershaft speed)

Fast countershaft speed $= C_F$

$$C_F = C_S \times r^{\frac{n}{2}} = s \times r^{\frac{n-2}{4}} \times r^{\frac{n}{2}} = s \times r^{\frac{3n-2}{4}}$$

CASE 4

ONE COUNTERSHAFT SPEED, DOUBLE BACK GEARS

No. of speeds $= n$

n must necessarily be divisible by 3

Low speed $= s$
High speed $= S$
Range $= R = S \div s$

Ratio of two adjoining speeds $= r = \sqrt[n-1]{R}$

Cone steps bring speeds from high to $\frac{2n}{3}$ speed

Fast back gear brings speed from $\left(\frac{2n}{3}-1\right)$ to $\frac{n}{3}$ speed

Slow back gear brings speed from $\left(\frac{n}{3}-1\right)$ to slow speed

Slowest speed of machine cone without using gears is $s \times r^{\frac{2n}{3}}$

$$C = \frac{d}{D} \times S = \frac{d}{D} \times sr^{n-1} = \frac{D}{d} \times s \times r^{\frac{2n}{3}}$$

$$\frac{D^2}{d^2} = \frac{sr^{n-1}}{sr^{\frac{2n}{3}}} = r^{\frac{n-3}{3}}$$

$$\frac{D}{d} = r^{\frac{n-3}{6}}$$

$$C = \frac{D}{d} \times s \times r^{\frac{2n}{3}} = r^{\frac{n-3}{6}} \times s \times r^{\frac{2n}{3}} = sr^{\frac{5n-3}{6}}$$

To find x and y follow Case 1-A substituting $s \times r^{\frac{2n}{3}}$ for s (as this is the slowest speed obtainable by direct drive).

Ratio of machine cone and shaft driven by fast back gears $= r^{\frac{n}{3}}$

Ratio of fast and slow back gears $= r^{\frac{n}{3}}$

CASE 5

ONE COUNTERSHAFT SPEED, DOUBLE BACK GEARS AND TRIPLE GEAR

No. of speeds $= n$
High speed $= S$
Low speed $= s$
Range $= R = S \div s$

Ratio of two adjoining speeds $= r = \sqrt[n-1]{R}$

Ratio of triple and back gear $= r^{\frac{n}{5}}$

Ratio of back gears $= r^{\frac{n}{2}}$

Ratio of shaft driven by fast back gear and machine cone $= r^{\frac{n}{2}}$

Countershaft speed $= C = sr^{\frac{9n-5}{10}}$

If small step $= d$ diameter

Large step $D = \frac{Sd}{C}$

Step $y = D + d - x$

$$C \times \frac{D + d - x}{x} = \frac{S}{r}$$

$$\frac{D + d - x}{x} = \frac{S}{Cr}$$

$$D + d = x\left(\frac{S}{Cr} + 1\right)$$

$$x = \frac{D + d}{\frac{S}{Cr} + 1}$$

$$y = D + d - x$$

Reo Connecting Rod Methods

A Double Milling Fixture—Babbitt Expanded in Holes by Rolling—A Neat and Accurate Gage for Inspecting Squareness of Bores

By FRED H. COLVIN
Editor, American Machinist

THE milling fixture used in the first operation is of different design than that usually employed for this work. It consists of a substantial framework built to contain two rods in a revolving fixture, so that one end is free for unloading and reloading while the cutters are at work on the other end.

The rod rests in the lower V's *A* and *B*, Fig. 1. The small end, however, is supported by an additional block which takes the thrust of the clamping finger *C*. Finger *D* centers and clamps the large end of the rod, both clamps being operated by a handwheel and screw above. A single screw holds both ends of the rod through an equalizing clamp.

Drilling the Large Hole

The large hole is drilled in the fixture shown at the right in Fig. 2. The rod is lightly held, the forged opening centering the drill and the pin *A* preventing the rod from turning under the cut. In drilling the small end, the large bore is used for locating and squaring the rod, as shown at the left at *B*. The quick-acting clamp *C* is a bit unusual, the handle *D* unlatching the locking block and allowing the rod to be swung out of the way after drilling.

After splitting the cap from the rod itself (the bolt holes being previously drilled and tapped), the studs are put in place and the cap assembled to the rod. It is then washed, tinned and babbitted as shown in Fig. 3. The rod slips over a babbitting mandrel which has strips to represent the shims, as at *A*. The cap is held

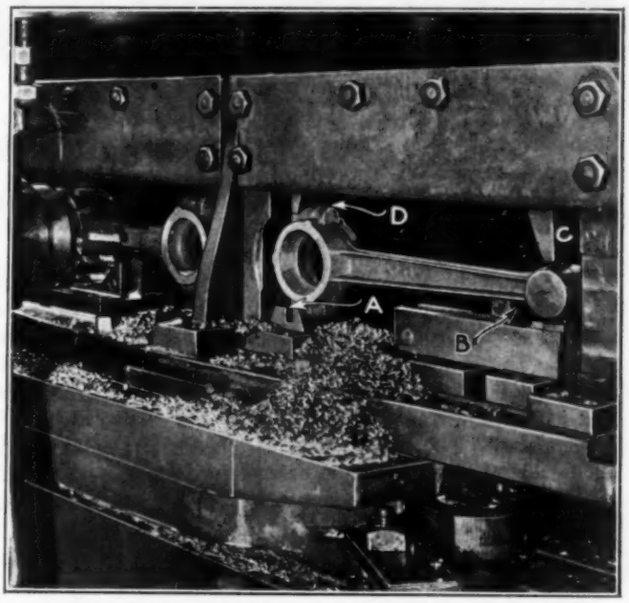
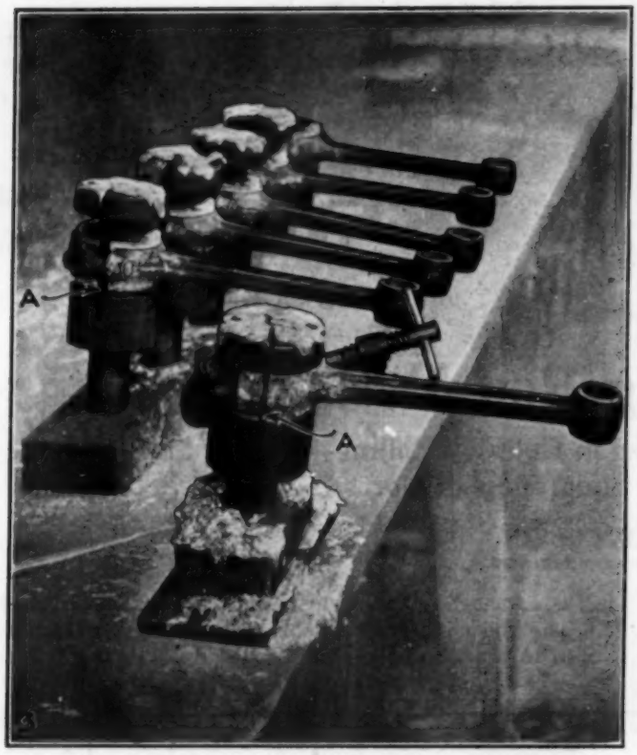


FIG. 1. MILLING SIDES OF CONNECTING RODS

FIG. 2. DRILLING BOTH ENDS OF ROD



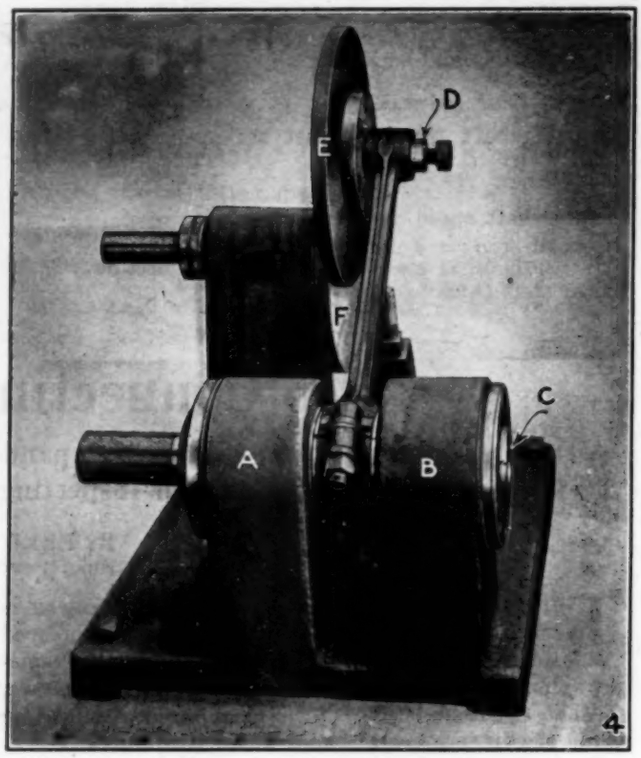


FIG. 3. BABBITTING THE RODS. FIG. 4. TESTING FOR SQUARENESS OF HOLES

in position by the clamp shown while the babbitt is poured.

The oil groove is next cut, the babbitt faced and rough reamed, and then spun with a rolling tool to compress the metal before the final reaming.

In Fig. 4 is shown the test for squareness of the two holes. The large end of the rod is placed between the heavy uprights *A* and *B*, and the plug *C*, representing the crankpin, is pushed in place. The stud *D* on the disk *E* is placed in the piston-pin hole and the rod is then swung so as to bring the disks *E* and *F* in contact. The large size of these disks makes it easy to detect very slight errors in squareness, and it is these errors which have much to do with causing undue wear and producing unsatisfactory motors.

In the final operations the oil dip on the end of the rod is formed, the oil hole carefully cleaned out, the rod buffed and weighed and sent to the assembling department to be fitted to the crankshaft as in Fig. 5.

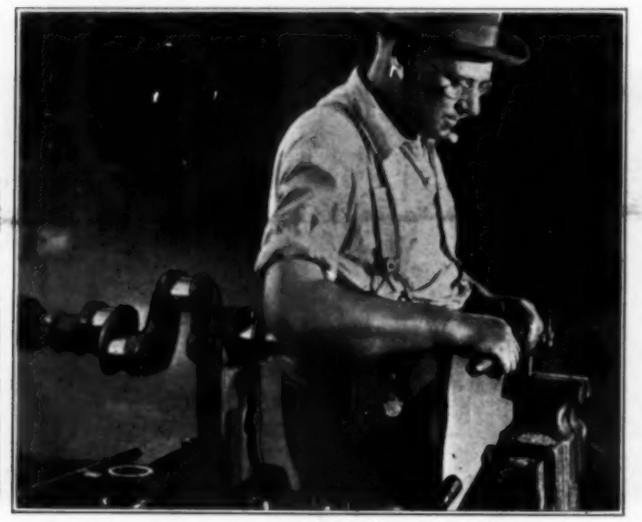


FIG. 5. FITTING RODS TO CRANKSHAFT

Chamber Urges Political Emancipation of Federal Reserve System

A statement issued recently by the finance department of the Chamber of Commerce of the United States urges protection of the Federal Reserve System from politics. The chamber's finance department emphasizes the fact that current uninformed criticism and misrepresentation may threaten the welfare of the system. Efforts that are being made to control the system's discount rates and to alter the composition of the Federal Reserve Board are not in accordance with sound principles, declares the chamber. It is not suggested that sincere and constructive criticism should be discouraged, but that for the moment it should be put to one side in order to confront what is believed to be dangerous tendencies that, unchecked, will promote a gradual ascendancy of political influence in affairs of the system, and contrary to the interests of all the people, undermine the independence of its administration.

The chamber's committee on banking and currency stated some time ago that in dignity the Federal Reserve Board should rank with the Supreme Court and should be equally free from any suspicion of political control. The department adds the opinion that the entire system should be kept non-partisan in character, free from the suspicion of the taint of politics, and should be protected from any efforts to manipulate it in the interests of any class or party, with consequent loss of public confidence in its integrity.

Some forty bills, proposing to amend the Federal Reserve Act, a few constructive but most of them unwise, have been introduced in the present Congress.

Factory Storekeeping and Material Control

The Second Article—Material Routine Personnel—Duties and Qualifications—Who Is Responsible for Quality, Quantity, Time and Cost—Location of Offices

By HENRY H. FARQUHAR

THE personnel concerned with material handling must necessarily differ both in quantity and quality, as well as in organization, with the particular factory dealt with. In any strictly regulated material procedure, however, whatever be the type of industry, the following duties must be performed regardless of whether or not the exact titles used below are employed, or of whether, as in the smaller plants, several of these duties may be combined in one person.

The function of the engineering department is to ascertain the proper quality of goods and to consider the uses to which each article is to be put. The results are written up in purchase specifications, which are repeated or referred to in the balance sheet. The engineering department must also inspect and test materials upon receipt to see whether they conform with these specifications.

The person in charge of this work must possess technical knowledge of a high order, he must possess firmness, backed by sound judgment, and he therefore requires an intimate knowledge of production needs. He may often be assisted to good advantage by various advisory committees appointed for the purpose.

The purchasing agent is responsible for purchasing all goods as and when called for at the lowest price consistent with quality. He is responsible for the follow-up of all outstanding purchase orders, and for seeing that delivery is made when promised. It is his duty to report at once to the proper person any change in conditions in the market or in transportation which may affect the time or amount of ordering goods. The purchasing agent should possess shrewdness, tact, common sense and ability to hold his own in an argument. Technical knowledge is an advantage.

The balance clerk is called also stock clerk, material clerk, material record clerk. The general function of a central clearing house, as embodied in the balance sheets, is to give all information in regard to material on hand, material outstanding on order, material which has been apportioned or reserved to manufacturing or other needs, and material which may be further apportioned or which is considered available. It is the duty of the balance clerk to keep the balance sheet for each item up to date by posting any one of the above transactions when it occurs, to see that perpetual inventory is accurately maintained, to requisition materials for stock as necessary.

The qualifications of a balance clerk require absolute accuracy, foresight and a whole lot of common sense. I strongly believe that first-class people should be used for balance card work. Bookkeeping is more or less mechanical, but balance work requires an alert mind. Much money may be lost or made at the balance cards.

Besides his general supervisory duties, it is specifically the duty of the works manager as regards material regulation to approve himself, or to delegate this authority to other officials, all replenishment orders before they may be honored by the purchasing agent.

An important duty of the traffic manager is to keep those responsible for the ordering of materials fully informed as to traffic conditions, so that ample allowance may be made for embargoes or other transportation upsets. Ordinarily this information should be reported to the purchasing agent who should then be held responsible for interpreting this and other relevant information into an allowance affecting the time or amount of ordering goods. It is the traffic manager's duty also to receive all goods from the transportation agent, to see that the packages correspond with the descriptions on the way bills or other descriptive documents, to certify the transportation charges to the auditor, and in general to conduct all dealings with transportation agencies.

The receiving clerk unpacks all packages and checks contents against his copy of the purchase order. He makes out a notification of receipt and sends it immediately to persons interested. This notification or an accompanying form must contain information showing action by the engineering department or other inspectors.

The transportation men move materials and apparatus into and out of storerooms and to other designated places as per directions.

The storekeeper is responsible for the receipt into stores, arrangement and stowage, custody, and issue from stores of all goods. He is also responsible for a periodic count to insure accuracy of perpetual inventory, and reduction of spoilage and deterioration.

The auditor checks invoices against notification of material received and notifies the purchasing agent to

> THE PERSONNEL concerned with material routine must be organized and physically located to give the greatest serviceability.
>
> Quality is determined by the engineering department; cost by the purchasing agent. Quantity is limited by production requirements.
>
> The storekeeper should work directly under the works manager, the balance clerk under the production manager.
>
> The production office should be close to the manufacturing departments. The balance sheets must be in the production manager's office but near the storeroom.
>
> The cost department should be supervised by the works manager, but located near the balance sheets and manufacturing department.

secure adjustment for rejected materials. He pays for those goods passing inspection, or if the policy of taking all cash discounts immediately upon receipt of invoice be followed, pays invoices upon presentation.

The cost department sees that proper charges and credits are made and summarized for all materials issued or returned, and that these transactions are properly taken up in the books of account.

Besides these functions, we have that of requesting material for use, exercised by various persons throughout the plant, and finally that of planning, which, while not directly related to material routine, is the center of production activities and enables the accurate forecast of material needs.

Naturally, depending on the size and complexity of the business, these functions may not be exercised by persons as listed above. Fewer persons may be required, or very many more may be necessary in larger plants. For instance, there may be one head material man, under whom would come several storekeepers, several balance clerks, special transportation men and so on. Similarly, the receiving department may be very large in itself, consisting of several men and several stenographers. On the other hand the storekeeper may in smaller plants serve also as receiving clerk, although this practice is open to considerable danger.

Regardless of the number of persons required, however, the functions to be performed remain the same, and ordinarily it is a mistake to split responsibility for any one function among different persons. Thus special considerations may require a usually unsatisfactory arrangement of several detached storerooms each with its own storekeeper. These should all report, however, to one man who heads the storage function.

Relation Between Departments

It is obvious that responsibility for the material routine rests with many officials of the plant. It therefore becomes necessary in individual cases to determine very carefully just what the relation of material regulation shall be to each of the departments affected, as well as the relation among the members of material personnel themselves, so that there may be no overlapping of functions.

Although no general rule can be laid down which will suit all cases, there are yet certain necessary relationships which should not be lost sight of in the distribution of functions in any case. On the one hand, a too great concentration of authority and responsibility may lead to fraud or careless work due to a lack of independent checks. On the other hand, by a too sparsely scattered arrangement work may be so slowed up as to be insufferable. The problem lies in choosing the middle ground between these two extremes. An illogical arrangement of functions, furthermore, may lead to complications quite as distressing as a too broad or a too narrow subdivision. Consider first the four major elements, quality, quantity, time and cost, into which material handling has been divided.

It would seem axiomatic that responsibility for quality of all goods should be centered in the engineering or other technical department. To this department, in the final analysis, must be referred all questions of quality of raw material or workmanship which affect the serviceability of the product which this department has designed. Since this technical department specifies in the beginning the quality of what is to enter into the finished product, it would seem only right that in it be centered responsibility for the inspection of incoming goods to determine whether they be suitable for use in the product.

Where a simple count and observation is all that is necessary, as is usually the case with most factory supplies, authority for inspection may be delegated by the engineering department to the receiving clerk. Responsibility, nevertheless, for this particular work of the receiving clerk must still be centered in the engineering department. There is here no occasion for divided or ambiguous responsibility in the receiving clerk's work, since quality inspection is a function that may be clearly set off from his other duties and for which he may therefore report without confusion to the head of the inspection department. Divided responsibility becomes dangerous only when two persons are responsible for the same function or duty.

Responsibility in Inspection Work

The necessity for central responsibility in inspection work was illustrated in one plant where it was perfectly well understood that all technical inspection was to be done by the engineering department. However it had been tacitly assumed that this office was not interested in or responsible for inspection of materials which did not have to go to the testing laboratory, as such materials had been customarily passed by the receiving clerk without specific directions for him to do so. This lack of a clear definite authority caused the loss of many dollars and delayed completion of work when unsuitable goods were passed for storage.

The determination of what quantity of material to buy usually rests with the production department, and in any event, must be determined through a consideration of production requirements. As indicated previously, and as will be discussed in detail further on, there are two kinds of purchasing, speculative and routine. Speculative purchasing, however, when it is done for a manufacturing establishment, should be limited in amount and in time by dictates of manufacturing needs. A safe rule to follow in this respect is that when the purchasing agent is permitted to depart from reasonably immediate needs of production in his purchases, the burden of proof must be distinctly upon him. In routine purchasing, of course, the purchasing agent is governed strictly by current replenishment orders.

The time element must be similarly divided between production and purchasing, the one specifying when to renew for all items as per balance sheets for production requirements, the other to be responsible for the time necessary to secure the article and for seeing that it be secured in this time.

The responsibility for cost rests of course with the purchasing agent. In practically all cases which I have encountered where losses were frequent, due to poor material management, the underlying cause was directly traceable to an illogical or to an ambiguous delegation of these four functions. Too often, indeed, they were all thrown upon the shoulders of one man, the purchasing agent.

As regards the administrative subdivision among the various other members of material personnel, there exists considerable difference of opinion. Accepting the concept that materials in the sense in which we use the word exist solely for the benefit of production, it would be logical that the balance of stores or worked

material clerk, the receiving clerk, and the storekeeper should all be under production. This arrangement is not at all universal, however. Probably the most common departure is where the storekeeper is under the purchasing agent. This has the disadvantages referred to previously of placing a department, the storeroom, which vitally affects production, under a man whose primary interest lies elsewhere, and of a too great concentration of authority in the lower limits of the organization. These arrangements at times have led to serious consequences.

The ideal arrangement both for purposes of safeguards and for incentive to quick and accurate action would have the storekeeper directly under the works manager and the balance clerk directly under the production superintendent or the head of the planning department. Here again practice differs, since the balance clerk frequently reports to the head of the cost department. Since the average cost accountant does not ordinarily appreciate the vital relation between manufacturing efficiency and control, such an arrangement again usually works out to a disadvantage. With the arrangement suggested, and particularly in the smaller plant, with the receiving clerk under the traffic department, which may in many instances report to sales, informed and energetic action as well as ample safeguards against collusion and fraud are provided. Clerical errors, furthermore, are much more readily caught where one department is working against another in this respect.

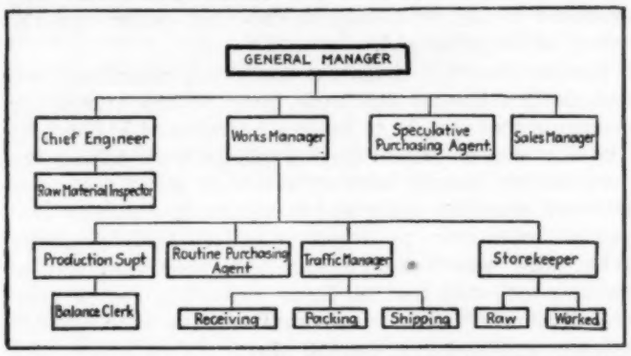


FIG. 1. ORGANIZATION CHART OF MATERIAL PERSONNEL

It must be emphasized, however, that these relations must vary with cases; that they are presented only as an arrangement which has been put in effect with excellent results in several different types of plants and which probably furnishes maximum checks with minimum labor and routine. Fig. 1 shows a skeleton organization chart of this arrangement of the material personnel.

The organization chart shows one satisfactory arrangement of the administrative relations between persons concerned with material routine. Yet even with a satisfactory organization it is always necessary to consider in addition the physical location of offices so that as a whole there may be a convenient working relation between them. The layout of the storeroom proper will be dealt with in a later article but since many cases of faulty work-relationship have come to light due simply to an improper physical location of the persons themselves, it may be useful to indicate some of the considerations which should govern the placing of these various functions.

In many cases the location for any specific department will be self-evident. For instance, in the case of the traffic department or at least that part of it which receives packages, obviously it should be placed immediately contingent to the railroad tracks and truck delivering platforms. This is both for the incoming and outgoing shipments, and necessarily the packing and shipping department should be immediately adjacent to the traffic office, whether or not these departments be under one head.

For convenience in the physical handling of packages, as well as for the transaction of the necessary paper routine, the receiving department should also be immediately adjacent to the traffic department. Here goods are received from the traffic, unpacked, checked with the copy of the purchase order and sent to the storeroom. They should pass a minimum distance from one to the other.

The storeroom, therefore, should be within reasonable truck or elevator distance of the receiving department. This is particularly true of a central storeroom, and of course the location of detached departmental or subsidiary storerooms must be carefully chosen with regard to delivery of incoming and outgoing goods.

I have encountered many cases of faulty operation of the balance of stores function due simply to the location of the balance sheets relative to the other departments with which the balance clerks deal. I consider it absolutely fundamental for effectiveness that the administrative authority for balance sheets be centered in a production official. Whoever may be intrusted with the supervision, however, there is but one logical location for the balance sheets themselves—immediately next to the production manager's elbow or whoever the official may be whose duty it is to look ahead and plan production and material needs. He is the one who has constantly to put future requirements for production against the amount of material on hand, on order, and assigned, and his work is very much handicapped unless balance sheets are instantly accessible.

This would seem almost axiomatic, and yet I have encountered numerous cases where there was a great deal of lost motion on the part of the production manager in sending or phoning to another department for information about material, information which should have been right under his thumb. The balance sheets, moreover, should not be too far from the storeroom, even where adequate automatic carriers are provided. There is much work in connection with stores handling and checking which cannot be done either by the regular factory mail system, by phone, or by pneumatic tube service, but must actually be done in consultation between the storekeeper and the balance clerk.

These and similar considerations point to the conclusion that the planning or production office should be situated just as close to the manufacturing departments and as centrally located relative to them as is possible. Follow-up will thereby be made not only easier, but also much surer and more systematic.

Cost Department Near Factory

For similar reasons I feel that the cost department, as distinct from the general accounting department, should be not only under the supervision of the works manager or the production superintendent but should be physically located close to the manufacturing department, and therefore close to the balance sheets. No matter how smooth a working system we may have, there are always innumerable questions which arise in regard to the correctness of time or job tickets, stores

or worked material issues and credits. inspection slips and numerous other sources of information which have to be adjusted in consultation between the storekeeper, the balance clerk, the cost clerk, and the foreman. Here again, any sort of communicating service will serve only for a portion of the adjustment. Ordinarily they must be made in person. When one has but to step out of his door as it were, to adjust some small matter, he is very much more likely to do it, and certainly can be very much more readily held to account for not doing it, than would be the case where this adjustment necessitated a long trip back and forth.

The general accounting offices, on the other hand, may be located wherever convenient, and it is very customary to find them in a large city many miles distant from the factory itself. There is no direct connection between general accounting and the shop. Most of the means by which costs are tied into the general accounts through reports of the cost office to the general accounting office and back again, should be worked up in the form of exhibits for the guidance of administrative officers anyhow, so that the general accounting offices may be located wherever desirable without inconvenience.

The location of the purchasing agent's office similarly may be wherever desired, although ordinarily this should be much closer to the works than the general accounting office, because of the constant necessity of consultation and the constant passage of papers between the purchasing agent and numerous other officials of the plant.

It will be understood that the above considerations apply to the plant of medium size. With increasing size, the problem of securing a balanced arrangement among various departments becomes increasingly difficult until in a plant of very large size decentralization becomes desirable. We then get back in considering individual units to the problem of the moderate sized plant just discussed. In every case, however, administrative relationships and the physical layout must be arranged so as to secure the greatest serviceability between related departments.

The Little Shop Around the Corner Is at Bat

By W. F. Sandmann

Ask any machine tool salesman what question has been hurled at him most frequently during the last six months, and almost invariably he will answer that it has been, "Who in the world is buying machinery nowadays?" or its equivalent—probably couched in more highly expressive language.

The belief of a great many manufacturing executives, especially in the large plants, is that the factories of this country are fairly bulging with surplus equipment, that they or no one else have any use for. They throw up their hands in horror or try to laugh out of their office the salesman that dares to suggest new machine tool equipment.

The alert machine tool salesman is now avoiding the big plants, almost to the point of neglect, and is wandering up the byways and side streets to the little unpretentious concrete block or frame building that shelters the shop that is doing the business. He doesn't find a cork-floored waiting room and an attendant at a mahogany information desk to take his card. When he enters the door he walks right into the shop proper and when he inquires of the nearest lathe hand for the proprietor he has pointed out to him the operator of a grinder or drill press who from outward appearances is a workman of the rank and file.

The salesman doesn't expect this proprietor-workman to stop working while he talks to him for the proprietor of the "little shop around the corner" is a busy man. Instead the salesman is more than likely to lend him a hand to lift a heavy piece of work on the machine while at the same time he explains the merits of some particular new equipment which he thinks will interest this working-manager. He finds him a ready listener and he is not laughed at when he broaches the subject of new machinery here, for the little shop around the corner is in the market.

Its big brother around the corner on the main street finds competition hard. The acres of buildings and the backbone of an organization that it must keep if it ever expects to do business again means that a sizeable overhead must be met on every article produced. The overhead of the little shop is the rent, power and the salary of the office girl.

During the rush times the machinery manufacturers and dealers wasted but little time on the struggling mechanic that sought to build a business of his own up the side street. Then the big plants were taking the machine tool output without quibbling about the price. Delivery was the thing and it was with difficulty that enough tools were produced to satisfy their demands. What time was there for the little shop that wanted but one tool, and that on terms extending over a number of months? The result was the little shop couldn't get the equipment it wanted then.

But now their turn has come. The little shops around the corner are at bat now and a home-run harvest they are reaping too! Recent radio developments have put hundreds of the little shops "on their feet" with a vengeance. The demand for cheaper automobile and screw-machine parts has helped them. The big plant with the idle equipment can't touch them when it comes to a bid, for they don't have to figure in the upkeep on scores of polished desks when they make a price.

Do the owners of the little shops scour the used tool market before buying? Of course they do, but when all is said and done the greater portion of the equipment they install is new, for they are too good mechanics to be led into buying the worn-out machinery of the rush time. They get new tools and they keep them new by constant personal attention because they have no money to throw away. Besides, new equipment is alluring in a way. It holds out promise of unlimited working life and there is comfort in the knowledge that when a machine is set up it will require no overhauling or replacement of parts before it is ready to do a day's work, and the repairman will be unnecessary for a long time.

Some of these little shops around the corner will grow and grow and spread out and accumulate overhead and some day be large enough to move out beside their older brothers on the main street. But just the same when business hits one of its inevitable periods of low ebb they will have to watch their step or some new little shop around the corner will be picking off the juicy morsels.

It's all in the cycle of manufacturing though; and what a truly life-saving cycle it is for the "peddler" of machine tools and the factories he represents.

The Grinding of Gear Teeth and Its Future in the Industry

Application of Ground Gear Teeth in the Automotive Industry—Overcoming the Effects of Heat-Treatment—Elimination of Noisy Gearing by Grinding

By R. S. DRUMMOND
Vice-President, Gear Grinding Machine Co.

THE production of gears for accurate and noiseless operation has been a problem for many years and the refinement of the machinery and methods of manufacture have gone forward with each year. We are indebted to the demand in automobiles for silent operation for a great many improvements in the methods and machines for the production of machine parts of great accuracy and low cost. This article will deal largely with the application of ground gear teeth to automobile transmission gears, as this is the field which has so far used the greatest number of gears with ground teeth. This large use of ground toothed gears is proportional to the use of heat-treated gears, and has been brought about by several natural influences, such as:

a—The demand for silent operation of gears loaded and idling. The willingness of sales agents to acknowledge that noisy operation was an evidence of inefficiency and wear;

b—The demand for an unusual long life of gears without wear of the teeth with its accompanying gear noises.

c—The demand for a hardened tooth surface, which introduced the distortion due to high temperatures of heat-treating processes;

d—The need to eliminate the last ounce of unnecessary weight.

The General Result

The general result of these demands is the present-day transmission. With all its faults it is one of the most serviceable and satisfactory parts of the car construction, so long as it operates without noise.

Aside from the auto-transmission the following are some important uses of ground gears:

a—Gears made of high manganese steel (approx. 13 per cent Mn.). This composition of steel can be machined only by grinding. Gears as large as 33 in. in diameter, 20 in. face and of ¾ diametrical pitch have been ground in our shops at Detroit. These gears and others like them are in use for as long as six years without injurious wear and have replaced other similar gears which had a normal life of six to ten months. The long life of these gears is due to the high manganese content and to the fact that the initial construction provided working surfaces which were properly finished to a smooth and accurate tooth shape.

b—Main drive gears of large electric locomotives. The first attempts at gear drives of this type were noisy and increasingly so as used, due to tooth wear. An effort was made to modify the objectionable sound and wear by the use of special teeth—spiral spurs, herringbone, etc. Then the plain spur gear type was tried with the tooth shape accurately and smoothly ground, and this is the accepted standard today, as it permits the use of heat-treated gears and the finishing of the teeth to such form and shape as will operate quietly and with minimum wear.

c—Airoplane driving gears, used especially by designers where power transfer is necessary between multiple power plants, and combinations of propellers in planes of large size.

d—Geared speed reductions of the spur gear type, where large horsepower is transmitted and the operating speeds are high. During the war such heavy-duty speed reductions were in demand and many sets were produced which operated under very large loads without objectionable noise.

e—Work on tractor gears—These gears were saved for good standard use at only a fraction of their first cost by the resurfacing of the teeth.

f—Plain bevel gears and pinions such as are in use in rear axles of automobiles. Many thousands of these gears have been saved for good use, literally taken from the scrap pile and converted into good silent drives.

g—The field of broaches and gages lends itself to treatment similar to gear grinding when the external surface is toothed or splined. There is also a large field of usefulness closely related to gear tooth grinding in the grinding of the splined portion of shafts.

A short review of the attempts at gear tooth grinding is of interest.

a—The earliest effort on record was made by a gear foundryman as early as 1874, at which time emery wheels were described in the patent file showing the wheel molded to the approximate shape of the tooth space. This wheel passed between the teeth, removing some roughness and burrs. This in no wise constitutes the placing of a finish gear tooth on a gear tooth—it was simply a roughing operation intended to replace the hand truing which had previously been done with files or chipping hammer.

b—From this date little is disclosed until the effort was made in a Leland-Ferris bevel gear grinder, shown by the patent files in 1898, at which time the edge of the wheel was used with a generating type of machine to form a surface on bevel gear tooth.

c—About this same time Cheney developed a similar machine, very little different from the Leland-Ferris type.

d—In about 1891 the Fellows Company produced a generating type of machine showing very little change from previous work done by Leland and Cheney.

e—A machine was developed in Germany by the Reinicke Co., of Chemnitz, Germany. This machine used the side of the emery wheel and generated the gear tooth form.

f—Patent files show in 1906 a Phelps spur gear

Paper presented at Buffalo convention of the American Gear Manufacturers' Association.

grinder which again is a generating type of grinder.

g—We also have in this country today generating types of machines manufactured by Pratt & Whitney, Garrison, and Less-Bradner Co. These machines are all of one general type, using the edge or the side of the emery wheel in generating the curve on the tooth surfaces. One distinctive type of gear tooth generated with emery wheels is shown in the patent of the Brown-Lipe Co. under patent issued to A. T. Brown in 1914. This machine operates with a very large segment wheel sufficiently large in diameter to approximate a flat surface where it contacts with the tooth in the grinding operation.

h—There are two other unusual types of machines for correcting tooth form. One of these is an experimental machine in use in some factories where a mechanical stoning device is in use; a piece of flat stone is rubbed against the tooth surface by the generating process. This is an awkward, inefficient and inaccurate device.

i—The second of these peculiar machines is represented by the device gotten up by Adler at Frankfurt-am-Main, where formed diamonds were set very accurately to the shape of the tooth to be formed and these diamonds so set were used as a means of trimming the revolving wheel, which was then placed against the work. It was necessary, as you will understand, to re-set these diamonds whenever they wore down. This method utterly failed.

j—It will be noted from the foregoing that a great many people have spent considerable time in an effort to properly generate the tooth form with emery wheels, in contradistinction to shaping the tooth form by the direct cutting section of the wheel when operated in the same way as the ordinary gear cutter.

With this short history of gear grinding, it can be realized that the original work done by the engineers of the Gear Grinding Machine Co. was accomplished along entirely different lines of effort. They sought to reproduce from master forms a gear tooth form upon the wheel, it being possible in a few moments to retrim the wheel and so replace the worn form without losing the setting of the machine.

It is possible on the Ward gear grinder, shown in the illustration, as used by our company, to first trim the wheel and use it for a roughing operation around the gear, removing the most serious inequalities and the extreme distortion of the heat-treatment. Then to retrim the wheel with great accuracy and remove from the teeth a finishing cut of very small amount, giving a perfect reduction on the tooth surface of the master forms from which the diamond trimmers are operated.

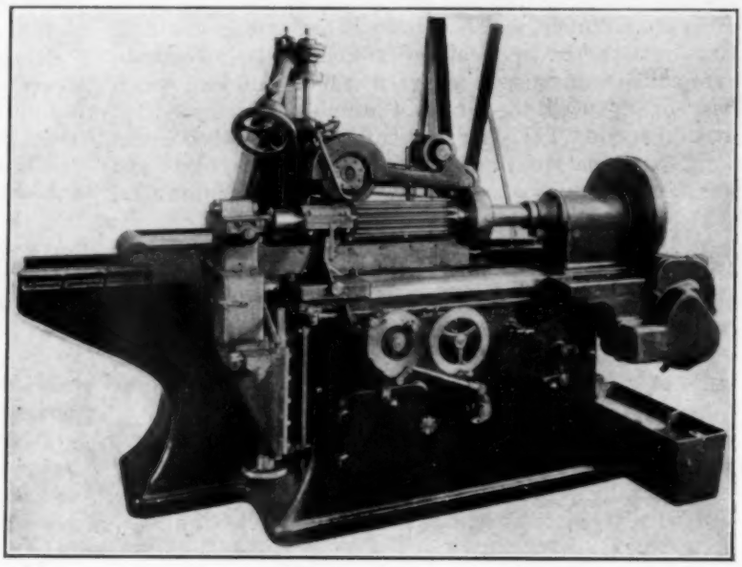
The wheel normally passes between two teeth, finishing adjacent sides of two teeth and bottom of the spaces, although it works with facility on one side of one tooth without grinding the adjacent side of the next tooth if desired. You will realize further that this gear grinder finishes the surface of the tooth from top to bottom as it passes over the tooth without small strokes which are used in some generating types of machines.

There are two distinctive uses for the grinding process for finishing gear teeth.

(1) The resurfacing of gears which have already been "finish cut" to size.

(2) The surfacing of gears which have been left with grinding stock.

Under the first of these headings we refer to the large volume of business which was done by gear grinders during the first five years that this work was actively done. The process was then used principally to salvage parts which had not passed inspection due to malformation of the teeth or distortion of their shape in heat-treatment. It is probable that one million gears have been resurfaced with gear tooth grinders with a large saving to the automobile industry. These gears, as a whole, were scrap parts which it was impossible to salvage by other processes on account of the high cost. When saved by this process of gear grinding the backlash in the gears was increased by the amount of stock which was removed from the surface of the teeth when they were corrected. This stock averaged from 0.003 to 0.006 in. on the tooth surface, adding backlash to a given gear from 0.006 to 0.012 in. in a tooth space, and such gears mated together would normally show an increase in backlash somewhere between 0.012 to 0.015 in. We will touch on the subject of backlash later.



THE WARD GEAR GRINDING MACHINE

The second division as mentioned above is the finish grinding of gear teeth which have been rough cut leaving grinding stock. Today this constitutes the largest volume of gear tooth grinding. The tendency of the market on gear teeth is decidedly toward this method of gear production, especially where the teeth are required to contact noiselessly at high speeds, and more particularly in automobile transmissions where the gears are heat-treated so that wear on the teeth will be small. In this portion of the gear tooth grinding business the refinement of the article, the finish of the gear tooth and its accurate form, is produced after the heat-treatment. This feature is really new to many people and yet it is very simple to understand, being exactly parallel to the work which is done on all other important surfaces used in the transmission of power.

The question is being asked, and asked properly: Should we use expensive machines and tools of extreme accuracy for finish-cutting, all tuned up and scraped to the last degree of accuracy; should we use

expensive refined cutters made with the most accurate form and shape, designed for production of teeth with maximum degree of accuracy; and then plunge the pieces at high temperature into a bath of oil or water and blame the results on anything but our own poor practice?

Years ago they turned shafts by accurate tools on most accurate machines, but today they leave grinding stock and finish-grind. Grinding has become so accurate a process in most parts for power transmission that roughing these parts on tonnage production machines has become standard practice.

During the last month we investigated twenty-three individual lots of gears for other companies. We found a wide variety of error, but the very largest was the distorted shape of the teeth due to heat-treatment. We have had teeth under test which could only have been produced on a rubber mandrel, or by distortion after machining, one tooth being slanted east and others slanted west. On the same gear, curves were low at points and high at points due to heat-treatment. We have heard a lot about heat-treatment within 0.0002 in., but we have not seen the evidence in quantity production. We have such high respect for temperatures over 1,000 deg. F. that we prefer to keep finished parts at a reasonable distance from them or grind the surfaces of parts after heat-treatment.

In an effort to overcome the warpage of heat-treatment the following methods have been used:

(a) Rolling gears together, then filing or stoning them to a smooth roll and a good appearance.

(b) Running the gears together relatively dry, permitting them to wear down the high spots and correspondingly wear grooves in the mating gears. Certain combinations of gear teeth can be improved in their roll by wearing a groove in one gear opposite the projecting rough places on the opposite gear. In the case of a "hunting" tooth, every tooth in the mating gear is thus damaged by the inequality in the mating gear.

(c) Running the gears together with a lapping compound causes maximum wear at the point of maximum pressure. This is like the previous method, but very much accelerated.

(d) Remating gears by hand rolling. Some operators when working on a limited number of types of gears become quite expert in mating gears with others of corresponding tooth curves. Thus they pick out a pair of gears with equally low curve position, etc. They do not always know what the result is, except that experience has shown them that the parts will work together. This process fails under severe or varied operating conditions.

(e) Mating gears by mechanical or optical measurement of the tooth form. This field holds a great benefit for the industry as soon as its use and application is cleared up.

One must consider that in a gear making tooth contact 14,000 times per minute, irregularity of contact will cause peculiar sounds. Many improperly shaped teeth cause an abrupt acceleration of the mating gear and equally abrupt slowing down. This reversal of acceleration occurring thousands of times per minute gives a harsh sound and produces rapid wear. A most common error is misplaced involute curves and irregular surface contact which cuts the oil film.

In the shape of the involute curve the shape is approximately radial near the base circle, whereas at the top it is very much rounded and falls away rapidly from a radial line. If this curve is misplaced downward as much as 0.005 in. this misplacement will effect the part of the tooth near the base circle very little but the effect at the top of the tooth is quite severe.

This effect occurred recently in a confusing manner. Idler gears were ground accurately from the bore of the gear, but made noise in the assembled transmission. Upon inspection of the idler it was found to be bushed and the bushing was eccentric, causing the tooth form to be high on one side and low on the other. The noise was not a sound of eccentricity, but a low growling sound. New accurate bushings corrected the tooth form position. One interesting feature of this transaction was that one idler which was cleaned up accurately with the tooth position and which was a loose fit on the shaft was relatively quiet.

(To be concluded in next week's issue.)

Standardization of Malleable Iron Chain

The following interesting paragraphs are taken from the report of a trade association in the industry manufacturing malleable iron chain:

During the period of fifty years in which malleable chain has been manufactured, its development had well illustrated the many abuses incident to growth without guidance and definite plans. Every time a manufacturer making a new machine decided to use malleable chain, it was common to call for a special type rather than to adhere to well developed sizes already made. This practice, which was often merely a whim, is also traceable to a mistaken policy of applying special parts for purposes of assuring an exclusive repair business. The result was an accumulation of thousands of slightly different patterns, lack of interchangeability to a marked degree, confusion and irritation to customers, and high costs to both the producer and the consumer.

The first step of standardization was the selection of an assortment of chains which would cover all reasonable requirements of design and application, which would be standard stock items. Beyond these an additional list was made, including chains required by certain manufacturers because of present design and demanded in reasonably large production quantities; these to be listed in catalogs but to be made up on customers' orders only. This plan gives the benefit of quantity production costs and shipment from stock to those customers who arrange to use stock items. Naturally this policy will continue the encouragement of the application of stock items.

The effects of elimination are shown in the case of one maker who listed 2,044 items previous to industry standardization, and who since then shows 820 items. This is a reduction of 60 per cent, although some types afforded greater opportunity for elimination than others, the maximum being 75 per cent in one type. However, it must be remembered that although 40 per cent of the items remain for catalog listing, there are probably only 20 per cent of the original number which are shown as being carried in stock.

Technical inquiry into dimensions led to consideration of weight, design and quality, resulting eventually in a cooperative series of tests of the present stock output. Over 2,000 physical tests and several hundred chemical tests have shown makers those possibilities which exist for the improvement of product and consequent increased serviceability.

It will be seen that the original suggestion from the War Industries Board which covered elimination of items only has developed a program of standardization—now accomplished—covering dimensional interchangeability, standard designation and the assurance of better product. The resulting benefits to both maker and buyer are self evident.

Alloys of Aluminum

Why Copper Alloy Is Preferable—Superior Casting Properties of Aluminum Alloys—Casting Alloy No. 12—How To Machine Alloys

FROM SALES DEPARTMENT CONDENSED DATA PREPARED BY THE TECHNICAL DEPARTMENT, ALUMINUM COMPANY OF AMERICA

THE two principal alloying ingredients of aluminum casting alloys at the present time are copper and zinc, usually taking the form of aluminum-copper or aluminum-zinc-copper alloys. Manganese and magnesium are frequently used. Nickel, chromium, tin and other metals have been alloyed with aluminum with varying degrees of success, but their application has never been very extensive and their use is advisable only in very special cases. Under certain conditions, bismuth, cadmium, lead and chromium do not mix with molten aluminum, but form two liquid layers in much the same way as do oil and water.

When commercially pure aluminum is alloyed with one or more of the common metals, the usual effects are an increase in the tensile strength and hardness, a reduction in the shrinkage and an improvement in the machining qualities of the metal. These are all desirable results for they correct those qualities in the pure aluminum which make it unfit for general casting purposes. These effects, however, are accompanied by a decrease in the elongation, which reduces the ductility of the metal and renders it more rigid.

Inasmuch as pure aluminum is very ductile a certain amount of its ductility may be sacrificed for greater tensile strength and hardness, without making the alloy too brittle for casting purposes. The degree of this sacrifice will depend upon the duty which the casting must perform. For example, a casting which will be subjected to the shock and vibration of an automobile motor will require an alloy very different from a casting which in actual service will be stationary and not subject to sudden shock or vibration. An alloy for the latter purpose may be stiff and rigid to an extent that would render it unsuitable in an automobile casting. Increased tensile strength and hardness are not always accompanied by a decrease in the elongation. However, there is usually a decrease in elongation when the increase in strength and hardness is caused by a change in the chemical composition of the alloy; but any change in the casting conditions which increase the tensile strength of an alloy, also increases the elongation; hence, there is a double gain of tensile strength and ductility.

What is true of alloying aluminum with small quantities of other metals is also generally true when other metals are alloyed with small amounts of aluminum. When this is done the good effects, as in the previous case, at first predominate, but the tendency for the ductility to decrease is present and it increases as the amount of aluminum increases.

In the United States the inclination of manufacturers toward the use of a very small number of standard alloys is, we think, a logical one. It is logical because the possible range of physical properties except for special purposes, may be obtained by the proper manipulation of very few of the infinite number of combinations of aluminum with other metals; because of the economies following increased efficiency of the foundry which standardizes on one or two satisfactory alloys; and last, but not least, because of the increasing good will which accrues to the account of the foundry turning out a uniform and reliable product.

The useful aluminum alloys may be divided into two groups: (1) Those of aluminum with not more than 20 to 35 per cent of other metals, and (2) those of other metals containing not over 10 to 15 per cent aluminum. Usually, alloys lying between these limits have no commercial value. Alloys of the former class are generally referred to as "light aluminum alloys" and those in the latter class as "heavy aluminum alloys." It is with alloys of the former class that we are here principally concerned.

All the useful alloys of the aluminum-copper series may be placed in one or the other of the two classes: Those containing less than 15 per cent copper, and those containing less than 11 per cent aluminum. The first class embraces the alloys most applicable to general casting purposes in the aluminum industry. The addition of copper increases the tensile strength and hardness, reduces the shrinkage and improves the machining qualities of the pure aluminum. The alloying also decreases the elongation, and thereby detracts from the toughness of the metal and ultimately limits the amount of copper that can be added. It has been found that an alloy composed of more than about 15 per cent of copper is not of practical use. However, if the copper content is kept well within this limit, the alloy is sufficiently tough for most uses. Because of the nature of their constituents, alloys of this class are not subject to burning in the foundry, as are alloys containing more volatile metals.

The copper content in this series of alloys is now fairly well standardized. After years of experimentation and commercial practice in which almost every combination of aluminum and copper has been tried, trade sentiment has gradually crystallized in favor of an alloy containing from 7.0 to 8.5 per cent copper.

INCREASED TENSILE strength and hardness, reduction in shrinkage, decrease in elongation, reduction in ductility, are the results obtained in alloying aluminum.

Copper alloys cast well and give little checking or drawing trouble.

Zinc is sensitive to temperature, which limits its application, requires very careful founding, but produces a sharp, sound casting.

Magnesium alloys are harder, stronger and lighter than pure aluminum. They have tensile strength equal to No. 12 Alloy and greater elongation.

This amount of copper produces a tough alloy the tensile strength of which will vary from 15,000 to 20,000 lb. per square inch, depending upon the casting conditions. It casts well and gives little trouble from checking and drawing of the casting, and is the one most generally used for all-round aluminum casting work. It is commonly known as No. 12 Alloy and will be discussed in detail later.

Alloys containing a higher copper content than this are sometimes used in the United States for castings which are to be subjected to high temperatures, water or steam pressure. A high copper alloy is frequently used in the die-casting industry because of its relatively low shrinkage. Inasmuch as castings made from such alloys may fail if subjected to repeated shocks and stresses, foundrymen should inform themselves as to the purpose for which the casting is required before they attempt the use of such alloys.

Alloys of the second class, containing less than 11 per cent aluminum, are known as aluminum bronzes. The aluminum content usually ranges from 1 to 10 per cent, that containing 10 per cent aluminum probably being most popular. A greater amount makes the metal hard and brittle, for the effect of aluminum is very similar to that of copper in the light alloys of aluminum. The tensile strength of aluminum bronzes is high, and ranges from 80,000 to 110,000 lb. per square inch. These bronzes do not corrode readily, and have a great resistance to alternating stresses, being superior to some steels in this respect. However, a detailed discussion of the aluminum bronzes will not be attempted here, for obviously they do not fall in the class of light aluminum alloys now under consideration.

Intermediate alloys of the aluminum-copper series, ranging from 15 to 90 per cent of copper, give crystalline and brittle grayish-white alloys of no use. After about 80 per cent of copper is reached the red color of the copper begins to show.

Zinc Sensitive to Temperature

The useful alloys of the aluminum-zinc series may, like those of aluminum and copper, be divided into two classes: Those containing less than 33 per cent zinc, and those containing a relatively small amount of aluminum.

The first class comprises the useful zinc casting alloys. Zinc produces a very strong alloy with aluminum, the tensile strength running as high as 38,000 lb. per square inch for the alloy consisting of 50 per cent zinc and 50 per cent aluminum. Such an alloy, however, is excessively brittle. The decrease in ductility of these alloys as the zinc content increases places the maximum of zinc at 33 per cent, and even this is much too high if the casting is expected to withstand stresses. The best aluminum-zinc alloys usually possess considerably less zinc than this. Zinc tends to give additional fluidity to aluminum, and produces sharp and sound castings when skillfully cast.

For forging, few metals excel an alloy containing from 10 to 15 per cent zinc. This alloy is tough, flows well under the forging dies and produces a finished product which is solid, easily machined and remarkably strong per unit of area. Castings made from aluminum-zinc alloys machine well, and the machining qualities improve with aging of the metal.

Alloys of this class seem to be unusually sensitive to irregularities in the casting process. If the metal is overheated there is danger that the zinc may be burned out. In addition, these alloys are more subject to drawing in heavy parts or lugs than are the copper alloys. This tendency, however, can in most cases be overcome by proper gating, suitable chills and risers, and adequate temperature control. Zinc alloys are unusually sensitive to high temperatures, and therefore cannot be used where the casting will be subjected to considerable heat. A casting made from a 25 per cent zinc alloy when raised to a temperature of 100 deg. C. loses one-third of the tensile strength it possessed at 20 deg. C. Zinc alloys have never been very popular in the United States. Doubt in the minds of many as to their freedom from deterioration with age has probably had much to do with their limited use. Recent tests by Rosenhain and Archbutt, however, seem to disprove such deterioration. The ease with which zinc alloys may be injured in the melting process may also account to a certain extent for their unpopularity. A better understanding of the peculiarities of this series of alloys will undoubtedly result in their more extensive use, particularly for small inexpensive castings which are not to be subjected to severe shocks or strains.

Alloys in the second class of the aluminum-zinc series, those composed of relatively small amounts of aluminum, are known as aluminized-zinc. The aluminum content is usually 5 or 10 per cent. These alloys are used in zinc galvanizing baths to make the bath more fluid and to clear it of oxides, and in the manufacture of aluminum brass, but they are never used directly as are the aluminum-zinc casting alloys.

Zinc-Copper a Favorite Alloy

As previously stated, an alloy of aluminum and zinc has never been very popular in the United States. Where zinc is used the trade favors the addition of small quantities of copper. Copper increases the tensile strength, improves the casting qualities and gives greater rigidity to the aluminum-zinc alloy. In England an alloy composed of 13 per cent zinc and 3 per cent copper is used quite extensively. In the United States an alloy containing 15 per cent zinc and 3 per cent copper finds most favor, and is known to the trade as No. 31 Alloy. These alloys, either with or without the addition of copper, have never been as popular in the United States as they are in Europe, especially in England, where such an alloy holds much the same prominent position as No. 12 Alloy occupies in the United States, being used for automobile castings and for casting work in general.

In general, manganese influences aluminum in much the same manner as copper, renders it first both harder and stronger but less ductile, and subsequently decreases the strength as well as the ductility. Manganese alloys are very resistent to corrosion, being superior to the pure aluminum in this respect, the resistance increasing with increase in the manganese content. These alloys are most frequently rolled into sheets, but as 1½ and 2 per cent manganese alloys are dense and close grained, they are not infrequently used for casting small parts, such as pipe fittings, which are to be subjected to water or steam pressure.

Alloys of magnesium with aluminum are usually known as magnalium. Because of the great affinity of magnesium for oxygen, these alloys tend to form considerable dross on remelting unless the magnesium content is low. As a result, it is not generally good practice to add more than 5 per cent magnesium. Most alloys

possess even less than this amount, and few commercial alloys carry over 2 per cent magnesium.

Magnesium alloys are harder, stronger and lighter than pure aluminum. Their tensile strength is practically equal to that of No. 12 Alloy, and their elongation is greater. Magnesium tends to make the mixture more fluid at low temperatures.

Magnesium may be introduced in the following manner: The pure magnesium is held in a pair of iron tongs and pushed slowly to the bottom of the crucible after it has been removed from the fire, or in the ladle just before pouring. It must be stirred slowly until the magnesium has completely melted from the tongs as determined by the sense of touch. The magnesium should be added in small amounts. If a long stick is pushed into the crucible it may break and the broken pieces float to the surface, where they will catch fire before they are melted, taking oxygen from the air instead of from the aluminum or the dissolved gases. After sufficient magnesium has been added more vigorous stirring should be continued for a short time in order to give the oxide of magnesium a chance to float to the surface. Then it should be poured and skimmed in the usual way. No other flux is necessary. Care should be taken to see that the tongs and magnesium are dry, to eliminate violent action and danger in introducing the magnesium.

Other Alloys Less Useful

Nickel is sometimes used as a hardener for aluminum, and produces practically the same effect as copper. However, as nickel costs more than copper, and as it has been found very difficult to make the nickel-rich alloy for incorporating the nickel in the melts, there is very little possibility that nickel will supplant copper as an alloying ingredient. The nickel content should never exceed 5 per cent, for a 5 per cent alloy develops practically the full tensile strength that can be obtained without decreasing the elongation to such an extent that the casting would be unsuitable for commercial foundry work. Aluminum-nickel alloys for casting purposes will probably never be used very extensively.

Small proportions of tin are sometimes advantageously used with aluminum to give greater strength and rigidity to heavy castings as well as to reduce the shrinkage of the metal. Tin also serves to give sharpness to the outline of the casting. This tendency, however, to reduce the elongation to the point of impracticability prevents the general use of tin-aluminum alloys.

No casting alloys of any value are formed by alloying aluminum with iron. A small amount of iron always occurs in aluminum as an impurity, but is only detrimental when it exists in amounts exceeding 1.5 to 2.0 per cent. The effect of more than these percentages of iron is to dangerously reduce the elongation. It also makes the molten metal sluggish, necessitating a higher temperature in the furnace with the consequent tendency toward blow holes and shrinkage cracks in the finished casting. There are very few commercial metals not chemically pure which contain as little iron as does the aluminum upon the market at the present time. Aluminum is extensively used as a deoxidizer in the manufacture of steel and is used in the form of the commercially pure metal.

Silicon in the ordinary casting alloys hardens the metal, reduces elongation and affects adversely the machining qualities when it occurs in too large quantities. Care should always be taken to keep the silicon content low, not exceeding 1.0 to 1.5 per cent.

Preparing No. 12 Alloy

As manufactured by the Aluminum Company of America, Number 12 Alloy consists of 7.0 to 8.5 per cent copper and not over 1.7 per cent other elements, balance aluminum. When properly cast this alloy can be depended upon to have the following physical properties:

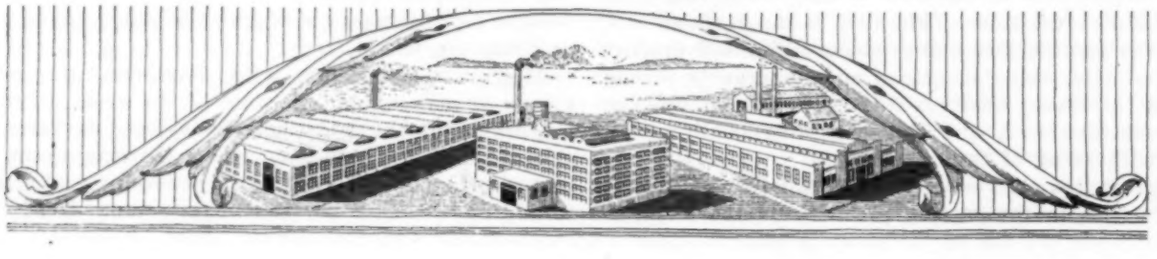
Tensile strength, pounds per square inch, sand cast	18,000
Elongation in 2 in., per cent	1.5
Specific gravity	2.84 to 2.87
Brinnell hardness (10 mm. ball at 500 kg.)	50–65
Shrinkage in inches per foot	0.18
Electrical conductivity, annealed copper taken as 100	30–35

The alloy is made in lots of approximately 11,000 lb. per heat. Each heat is carefully guarded as to the amount and quality of the ingredients, is melted under rigid pyrometric control and is subjected to detailed chemical analysis.

This alloy is used extensively in the automobile industry for crankcases, transmission housings, oil pans, etc., and for all general casting purposes which call for a tough and strong alloy capable of withstanding repeated shocks and vibration. It was successfully used in the difficult Liberty motor castings, for which the requirements were exacting and the inspection very rigid.

The time saved in machining aluminum is often sufficient to make an aluminum casting requiring a great deal of machining, cheaper than an iron or brass casting of the same kind. Tools should be operated faster for aluminum than for brass while the feed should be slightly slower. A good lubricant should always be used. For boring and reaming pure lard oil is the best, while for turning and facing, a mixture of lard oil and benzine, 50 per cent each, works well. For all jobs of tapping and chasing and for general work, an ordinary non-alkaline cutting compound is used.

Tools should be ground with plenty of clearance; that is, they should increase slowly in thickness from the edge. A razor blade is an example of extreme clearance. While tools for machining aluminum should not, of course, have clearance to that same degree, they should have considerably more than similar tools used for machining brass or iron. The cutting tools should have a highly whetted edge such as would be used in woodwork, for dull tools will tear and drag the aluminum.



Geometric Progressions by Short-Cut Methods

The Value of These Progressions to Standardization—Four Simple Methods—How They May Be Utilized in Machine Design

By LUTHER D. BURLINGAME
Chairman, Sectional Committee of A. S. M. E. and S. A. E. on Standardization and Unification of Screw Threads

THE use of geometric progressions for proportioning mechanical work has been greatly increased in recent years, because there has been a growing realization that for many purposes proportions are best graded when in geometric progression. This is true, whether it is a question of the proportion for spindle

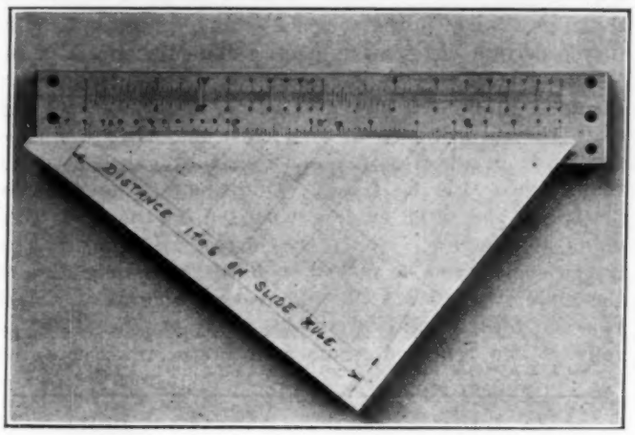


FIG. 1. GEOMETRIC PROGRESSION FOUND WITH SLIDE RULE AND CROSS-SECTION PAPER

speeds from the slowest to the fastest, for feeds from the finest to the coarsest, or of the proportion for screw diameters, wire gage sizes, key sizes, or diameters of arbors, or whether it is determining the capacities or proportions of a series of machines.

Recent work in standardization has brought the advantage of the use of geometric progression very prominently to the front, and one of the first tests to be applied to any new line of standardization is whether the sizes or proportions recommended follow a geometric progression.

The principle of having the feeds of machine tools such as milling machines, for example, follow a geometric progression, has been used for a great many years. The Brown & Sharpe milling machines on the market in the '80's had belt feeds so proportioned, and geared feeds and speeds have since followed the same rule. In 1895, Carl G. Barth took out a patent for a feed operating device which included a train of gears in geometric progression, and in this patent he emphasized the importance of proportioning the feeds in such a progression.

The German engineers, in their recent standardization work, have proposed a series of "preferred numbers" in geometric progression, these numbers ranging from 10 to 100. In the "20" series the selected numbers are spaced in geometric progression from 10 up to 100 in twenty steps, making twenty-one preferred numbers in the series. The alternate numbers produce a "10" series of eleven preferred numbers, while again taking the alternate numbers of the "10" series produces a "5" series of six preferred numbers, so that different requirements can be filled depending upon how close the succeeding steps should be to each other. This all tends toward uniformity in scientific work and correlates the varying lines of standardization.

In many cases an approximation only is desired in the nearest round numbers. But this must be one that still approaches a geometric progression, and is based on that principle. When such is the case, short-cut methods which can be readily used become especially useful. This applies also to standardization and similar work which requires reviewing or inspection and where such methods can be used to check the work of others.

I have found several different short-cut methods that have proved convenient, and the one to be chosen depends on the particular conditions of the problem. As these methods may be useful to the reader, I will describe them with simple problems to show their application. The first method can be applied if a slide rule and cross-section paper are available.

As an example, find the proportion for the shaft keys of shafts from 1 to 6 in. in diameter. It is determined that to adequately provide for the needs, there shall be thirteen sizes of keys within this range. Both the keys and the diameters of shafts where the keys change from one size to another, to give the best range, should be in geometric progression to the nearest even fractional sizes.

To find the geometric progression for diameters of shafts between 1 and 6 in., space with a compass on the slide rule the distance from 1 to 6. On the section paper with the compass so set, strike a radius until it intersects some line which can easily be divided into twelve parts because there are twelve steps in the series. For example, 3 in., divided into quarters give twelve steps.

TABLE I. PROPOSED STANDARD FOR KEYS
13 Sizes, 12 Steps.

Shaft		Key	
Geometric Progression	Approximate Fractional Size	Geometric Progression	Approximate Fractional Size
1.00	1	0.250	$\frac{1}{4}$
1.16	$1\frac{1}{16}$	0.290	$\frac{5}{16}$
1.35	$1\frac{3}{8}$	0.338	$\frac{3}{8}$
1.57	$1\frac{9}{16}$	0.393	$\frac{7}{16}$
1.82	$1\frac{13}{16}$	0.456	$\frac{1}{2}$
2.11	$2\frac{1}{8}$	0.529	$\frac{9}{16}$
2.45	$2\frac{1}{2}$	0.612	$\frac{5}{8}$
2.84	$2\frac{7}{8}$	0.712	$\frac{3}{4}$
3.29	$3\frac{1}{4}$	0.828	$\frac{13}{16}$
3.82	$3\frac{3}{4}$	0.960	1
4.45	$4\frac{1}{2}$	1.115	$1\frac{1}{8}$
5.15	$5\frac{1}{4}$	1.295	$1\frac{5}{16}$
6.00	6	1.500	$1\frac{1}{2}$

Draw a diagonal line where the radius intersects the 3-in. line. The quarter inches on the cross-section paper will subdivide the space on the slide rule from 1 to 6 into twelve equal parts. After the paper has been cut or folded along the line of the diagonal as shown in Fig. 1, it may then be laid against the graduations on the slide rule and the sizes of the shaft in geometric progression read and tabulated. These results will be found in Table I where the approximate fractional sizes selected are also given. When the smallest and largest keys to be used are determined, the geometric progression between these limits will

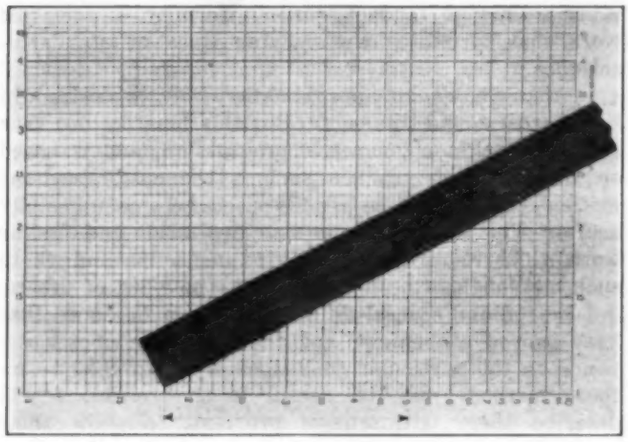


FIG. 2. GEOMETRIC PROGRESSION FOUND WITH LOGARITHMIC PAPER AND SCALE

indicate the proportions which the keys themselves should follow. Table I gives also the geometric progression of keys from ¼ to 1½ in. and the approximate fractional sizes.

Where logarithmic paper is available it can often be used to advantage for this kind of a problem. As an example, design a line of milling machines of six sizes with the longitudinal travel of the smallest 18 in. and of the largest 30 in. To have the longitudinal travels vary in geometric progression, divide the space on the logarithmic paper between 18 and 50 into five equal

TABLE II. MILLING MACHINE SERIES
LONGITUDINAL TRAVERSE
6 Lengths, 5 Steps

Geometric Progression	Selected Series	Geometric Progression	Selected Series
18.0	18	33.1	33
22.1	22	40.7	41
27.1	27	50.0	50

parts. This can be done by laying an ordinary scale diagonally on the paper at such an angle that 5 in., as five steps are required, coincide with the lines 18 and 50 as illustrated in Fig. 2. Each inch space on the scale will represent one of the steps in the series. The figures given in Table II will thus make up the range of longitudinal travel such a series of milling machines should possess.

In another method which suggested itself as especially convenient for many problems of this character, the slide rule is set in a block of wood, so that an ordinary foot rule and triangle can be used in connection with the block to read off the proportions. The block shown in Fig. 3 answers all the requirements. It may be of interest to note that this block, made by a patternmaker, was completed within seven minutes from the time the job was first put into his hands. This period includes the time required for instructions as to what was wanted. This is mentioned as an illustration of how simply and cheaply many jobs may be done and prove satisfactory, if conducted in the right way.

TABLE III. DIAMETERS OF BEARINGS
FOR SERIES OF LIMITS AND TOLERANCES
5 Diameters, 4 Steps

Geometric Progression	Selected Diameters	Geometric Progression	Selected Diameters
0.500	½	3.230	3½
0.932	1	6.00	6
1.730	2		

To illustrate the use of this apparatus in connection with standardization work, determine the sizes of the bearings at which the tolerances and limits should be increased in a series up to 6 in. in diameter, and assume the proportions to be varied in six steps. If ½ in. is assumed to be the largest size of the first step and 6 in. the largest size of the final step, then the geometric progression of five sizes, or four steps, between these limits can be found. One end of the scale is placed on the block in line with 0.5 on the slide rule using a triangle to secure the correct alignment. The triangle can then be moved to 6 on the slide rule and the scale swung with the end resting against the steel rule as a pivot until the 4-in. point on the scale, as four is the required number of steps, intersects the

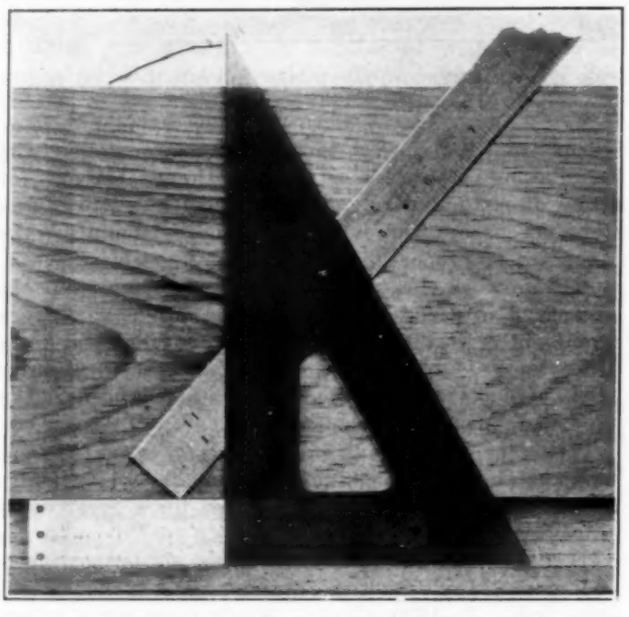


FIG. 3. SIMPLE APPARATUS TO USE WITH SLIDE RULE

edge of the triangle. Then the reading on the slide rule, when the triangle is brought in line with each even inch of the scale, will give the desired geometric progression.

This involves a condition which did not exist in the first two problems, where the largest size is more than ten times the size of the smallest. Therefore this requires that the reading shall be on the upper scale of the slide rule where the series is repeated, although by extending the slide of the slide rule as in Fig. 4 it could be read on the lower scale if greater accuracy were required. In this case the scale should be set so

that the 8-in. mark coincides with the edge of the triangle when the latter is set at 6 on the slide rule, and each reading should be taken 2 in. apart on the scale.

In Fig. 3 is shown the triangle set at the 1-in. mark for the second reading, and shows that the next size above 0.5 in geometric progression would be 0.932. Table III gives the complete series and the approximate fractional sizes.

The last illustration, Fig. 4, indicates the method of calculating a series which has an extreme range that will require the use of the full upper scale with the

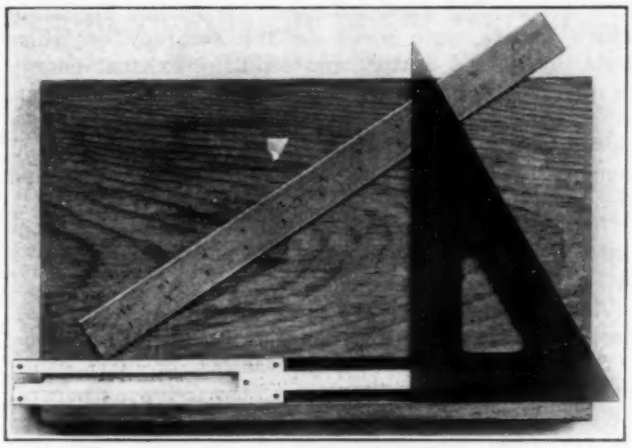


FIG. 4. APPARATUS SET FOR EXTREME VARIATION, USING ALL FOUR OF THE SERIES ON UPPER SCALE AND SLIDE

slide extended. For an example of this kind it is convenient to use a pocket slide rule because it is so short that such a series can be obtained within the range of the ordinary one-foot rule and draftsman's triangle and with a comparatively small-sized guiding block.

As an example, obtain a range of numbers from 4

TABLE IV. SERIES OF NUMBERS FROM 4 to 10,000
11 Series, 10 Steps

Geometric Progression	Selected Round Numbers	Geometric Progression	Selected Round Number
4.0	4	440	450
8.8	10	960	950
19.2	20	2,080	2,100
41.8	40	4,600	4,600
91.0	90	10,000	10,000
199	200		

to 10,000, with ten steps, making eleven in the series. Set the end of the steel scale in line with 4 in the first series of the upper scale on the slide rule. Set the triangle at 1, for 10,000, at the extreme right-hand end of the slide on the slide rule when the latter is extended, and swing the steel scale until the 10-in. mark intersects the face of the triangle. Then each inch on the scale will be in a position to indicate the corresponding geometric progression as the triangle is pushed along the block. Fig. 4 shows the setting at the eighth step to be 2,080. Table IV gives the complete series approximately.

An early application of the principle of geometric progression to mechanical work was made in the production of the American or Brown & Sharpe wire gage (designed in 1857 by Lucian Sharpe of the Brown & Sharpe Manufacturing Co.), which had forty-four published sizes ranging from 0.006144 to 0.460. The British Association screw thread standard is also arranged in geometric progression. Series like these can be readily laid out or checked by the methods shown above.

It is believed that an appreciation of the ease with which these methods can be used even by those who are not technically trained would lead to a much more general use of a principle which, when properly applied, will give the fewest numbers in a series to cover the requirements, whatever these may be, and thus secure the most satisfactory results.

The Foreman's Duties

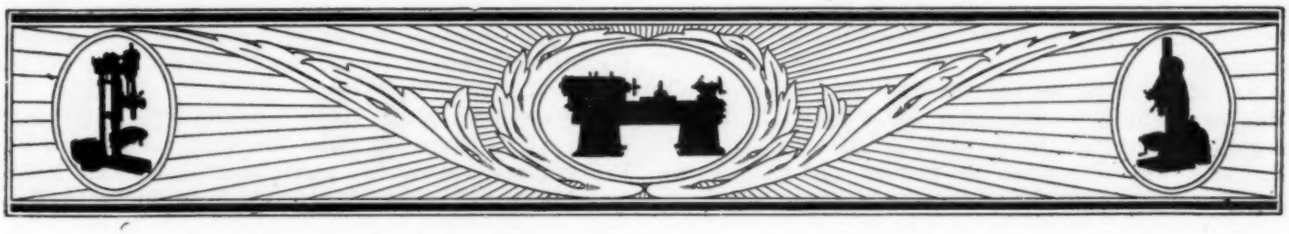
BY ROBERT GRIMSHAW

The foreman's duties are manifold enough, even when under modern organization methods the functions of each one are limited in number and scope, and delegation of details is carried out in the highest degree compatible with the character of the business and the number and variety of its employees.

The modern tendency—that of functional foremanship—substitutes for the intimate relationship of each foreman to only a comparatively small group of workers, over the members of which he exercises supremacy in connection with all their activities, an entirely different standing. It charges a foreman with a group of duties rather than a group of workers and in that connection may (or may not) have to do with every worker in the place.

Formerly he employed, assigned, and discharged at will, every worker in his group. Now, where the plant is large enough, he employs and discharges none, and assigns few; but in proper understanding with an employment foreman or an employment bureau, accepts what human materials are confided to his direction, seeing to it that their duties in his particular branch—and in no other—are discharged with the greatest possible efficiency, and leaving to various foreman-specialists the duty of determining machine speeds, making repairs, furnishing power, and the like, the realms of these specialists embracing the entire plant.

This principle of division of labor, so long profitably employed in industry, makes for individual efficiency on the part of each of these specialist foremen, and of the workers under him, and contributes to—in fact constitutes—the efficient and economical working of the entire establishment.



Atlanta Entertains the Mechanical Engineers

Important Matters Discussed at Business Meeting—Side Trips to Other Southern Cities Feature of Semi-Annual Convention—Textiles and Power Divide Honors

NO HIGHER tribute could be paid to Atlanta hospitality than to say that its warmth equals that of the city's May weather. The Atlanta section laid itself out to entertain the members of the American Society of Mechanical Engineers and succeeded nobly. The semi-annual convention began with a council meeting on Monday, May 8, and broke up Thursday evening to scatter to Birmingham, Greenville and Muscle Shoals. Some of the members attended a two-day session at Charlottesville, Va., on the way to Atlanta and had a chance to get acquainted with the beautiful campus of the University of Virginia. Joint meetings were held with the Society for the Promotion of Engineering Education.

The main subject before the business meeting on Monday afternoon was the discussion and acceptance of the proposed new constitution of the society. The suggested draft was presented by John L. Harrington, of Kansas City, chairman of the committee on constitution and by-laws.

Revised Version of New Constitution Adopted

President Kimball presided at the meeting which adopted a considerably revised version of the proposed draft after three sweltering hours of argument and parliamentary procedure. A number of minor changes were made and several important ones, notably, the retention of the minimum age limits for members and associate members as given in the old constitution, and the rejection of the provisions in the new constitution for changes in the make-up and terms of office of the council, in favor of the arrangement existing at present. The principal reason for sticking to the old system was the fact that under it a greater aggregate number of years of experience on the council is provided. The new article required a minimum of but sixteen years of total experience while the old article gave twenty-seven. In view of the growth of the society to over 16,000 members and the vital need for providing for an enduring policy extending over a period of years, it was felt unwise to curtail the experiences of the council members.

The next order of business was the report of the joint committee on a code of ethics for engineers. The report was presented by Prof. A. G. Christie, chairman of the joint committee which was composed of members from the societies of mechanical, civil, mining and electrical and heating and ventilating engineers. It was adopted without change.

The hour was then so late that no report from the representative on American Engineering Council was made other than the reading of a telegram stating that Secretary Hughes had announced that the patent treaty with Germany which existed before the war would be renewed.

An added event on the program was a short talk Monday evening by Rear Admiral Fullam, U. S. N., urging support for the development of naval aviation. His talk was illustrated by moving pictures of the bombing of the "Alabama" and the "Ostfriesland."

Tuesday morning was given over to simultaneous sessions on textile machinery in which papers were presented by S. E. Gillespie on cotton-ginning machinery, and by E. H. Marble on maintenance of textile machinery; on materials handling in which F. L. Leach read a paper on material handling machinery as used in the iron and steel industry; on general topics in which papers were given on the accuracy of boiler tests, by Alfred Cotton, and on using exhaust energy in reciprocating engines, by J. Stumpf and C. C. Trump. At the same time there were public hearings on three power test codes; definitions and values, displacement compressors and blowers, hydraulic power plants and their equipment.

In the afternoon there were local excursions about Atlanta, to the famous Stone Mountain and to the Atlantic Steel Company's mills.

A dinner dance at the Ansley Roof Garden on Tuesday evening was the high point in the social activities.

Simultaneous professional sessions on Wednesday morning included presentation of the following papers: "Weaving Machinery," by L. B. Jenckes; "Extraction of Oil from Vegetable Matter," by Jos. Davidson; "Modern Shop Practice in the Building of Revolving Flat Cards," by F. E. Banfield, Jr.; "Reduction of Fuel Wastes in the Steel Industry," by F. G. Cutler; "The Control of Boiler Operation," by E. A. Uehling; "Boiler Room Performance and Practice at Colfax Station, Duquesne Light Co.," by C. W. E. Clarke; "The Muscle Shoals Plant and the Nitrogen Supply," by Maj. J. K. Clement; "Heat Losses from Bare and Covered Wrought Iron Pipe at Temperature up to 800 Deg. F.," by R. H. Heilman; and "The Evaporation of a Liquid into a Gas," by W. K. Lewis.

A real Southern barbecue occupied all hands at noon on Wednesday and those who had ambition enough left followed an exhibition golf foursome over the excellent links of the East Lake Country Club.

The Technical Sessions

More technical sessions followed on Thursday morning. The papers were: "Management Applied to Textile Plants," by George S. Harris; "The Southern Worker—His History and Character," by F. H. Neely; "Power Development in the Southeast," by Chas. G. Adsit; "Economics of Water-Power Development," by C. A. Mees; "Hydroelectric Power-Plant Design," by John A. Sirnit; and "The Report upon Efficiency Tests of a 60,000-kw., Cross-Compound, Triple-Cylinder Steam Turbine," by H. B. Reynolds and W. F. Hovey; "Strength of Electrically Welded Pressure Containers," by R. J. Roark; "Some Principles of the Construction of Unfired Pressure Vessels," by S. W. Miller; "Steel for Forge Welding," by F. N. Speller; and "Tests on Welded Cylinders," by E. A. Fessenden and E. J. Bradford.

The members of the party interested in textile machinery left Thursday night for Greenville, where on Friday they visited the plants of the Duncan Mills, Branden Mills, Judson Mills, American Spinning Co.,

Woodside Mills and Union Bleachery and Finishing Co., the American Cast Iron Pipe Company, Ensley Plant of Tennessee Coal, Iron and Railroad Company, Fairfield Plant of the Tennessee Coal, Iron and Railroad Company.

Those who wanted to inspect steel mills and power plants went to Birmingham on Friday and visited the plants of the American Cast Iron and Railroad Co. On Saturday they inspected the Wilson Dam and the government nitrate plants at Muscle Shoals.

Romances of Metal Working—Saint Eligius the Metal Worker

BY H. H. MANCHESTER

In Saint Eligius, we come at least to an historic character, though some of the legends concerning him stretch the belief of the present day.

He was born near Limoges in France at the end of the 6th century A. D., and, when a boy, was apprenticed for seven years to the goldsmith Abbo, master of the mint there. After acquiring considerable skill in metal working, he went to Paris as a journeyman and began to work for Bibo, who was treasurer for Clothair II.

Not long after this Clothair ordered a new throne, and for this purpose put into Saint Eligius' hands the gold and other precious materials for the purpose. From this Saint Eligius produced a wonderful golden throne, heavily engraved and ornamented. Clothair was so pleased that he asked Saint Eligius what reward he desired. For answer Saint Eligius brought to him a second golden throne which he had produced from the materials left over from the first. Clothair was so struck with his honesty that he at once made him master of the mint. After Clothair's death Saint Eligius continued to hold this office under Dagobert.

At first Saint Eligius dressed outwardly as the others, in fine raiment ornamented with gold and jewels, but with sackcloth next to his skin. Later he sold his jewels, gave to the poor, and dressed as a monk. In fact he founded an important monastery in Limousin. He was made Bishop of Noyon in 640 A. D.

All this time he was busy making shrines for the relics of the saints, as well as vessels for the churches, and he became very skillful not only in manipulation of the precious metals, but of iron and bronze. He was supposed to have acquired all of the secrets of metal working, and to have made many improvements.

Some of the mediaeval pictures of his shop represent the drawing of wire there by main strength through a draw plate. This invention used to be ascribed to Rudolf of Nuernberg, but as we know it was in use long before, it may have gone back to Saint Eligius.

He is also represented in art as shoeing a horse, having the horse's leg or foot in his hand. This is in commemoration of a mediaeval myth which was told, not only about Saint Eligius, but with variations concerning several of the other saints. There was at the time a blacksmith who knew something of black magic, and had put a sign over his shop in which he boasted that he was master of all master smiths. One day, however, when Saint Eligius was passing by, he found the blacksmith having great trouble in shoeing a very refractory horse, and swearing mightily over the job. Saint Eligius stepped up and offered to do the work unassisted, to which the smith assented with a doubting

ST. ELIGIUS SHOES THE HORSE

laugh. The saint thereupon took off one of the feet of the horse, nailed on the shoe and put the foot back on again, the horse meantime standing contentedly by. Then Saint Eligius repeated the operation until all the hoofs were shod. While the smith was astonished he was enough of a wizard himself not to be nonplussed. "Well," he admitted, "that's a mighty good notion; I'll do it myself." He actually tried it on the next horse. Of course he could not put the leg back on again, and before Saint Eligius would do it himself, the smith had to promise to be converted.

Wildly impossible as this superstition is, such mixtures of fact and fancy are highly typical of the legends that gathered about even historic characters in the Middle Ages.

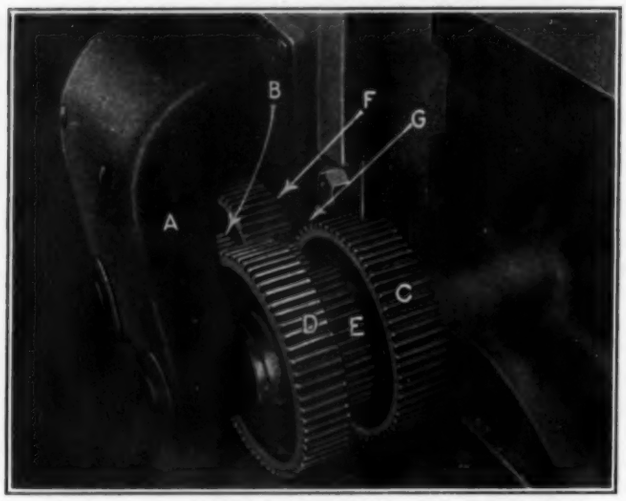
Ideas from Practical Men

Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered and those published are paid for.

Speeding Up an Old Planer

BY MILTON WRIGHT

We had an old 42-in. planer, built many years ago by Mark Flather, Nashua, N. H., the table speed of which was altogether too slow to keep up with the trend



TRIPLE GEAR REDUCTION ON A PLANER

of modern times. We desired to increase it so that we could use high-speed tools to advantage.

Speeding up a planer would seem at first glance to be a matter of belts and pulleys, but in this case there was a limiting factor that had to be considered. This planer was designed for a table speed of 20 ft. per minute and in the place of the nest of gears shown in the illustration, there was the usual single reduction, with a very small pinion on the first shaft and a very large gear on the second.

Even at an additional 10 ft. per minute these gears made trouble and the planer threatened to jump off the floor at each reversal. The shafts were therefore taken out and longer ones substituted, the bracket *A* made, and the "triple back gear" reduction put in place as the illustration shows.

The pinion *B*, only one or two teeth of which are visible in the picture, is keyed to the first shaft, the latter extending far enough beyond it to take a bearing in the bracket. Gear *C* is keyed to the second shaft, upon which (inside the bed) is the pinion that meshes with the bull wheel.

Gear *D* and pinion *E* are doweled securely together upon a substantial bushing which turns freely upon the second shaft. Gear *F* and pinion *G* (the latter not visible in the picture) are similarly mounted upon a bushing that floats upon the first shaft. Generous oil-holes and channels are provided to conduct lubricant to the various bearings.

The drive may easily be traced by the letters. Pinion *B* drives gear *D* and with it pinion *E*, pinion *E* drives *F* and *G*, and *G* drives gear *C* on the second shaft, thus constituting a triple reduction where before there was but a single one.

The speed of the countershaft was brought up to the requisite limit by suitable pulleys, though not in proportion to the increased table speed, as the pinion *B* is considerably larger than the one it replaced. The table now travels 50 ft. per minute with less shock at reversal than resulted from the original slow speed.

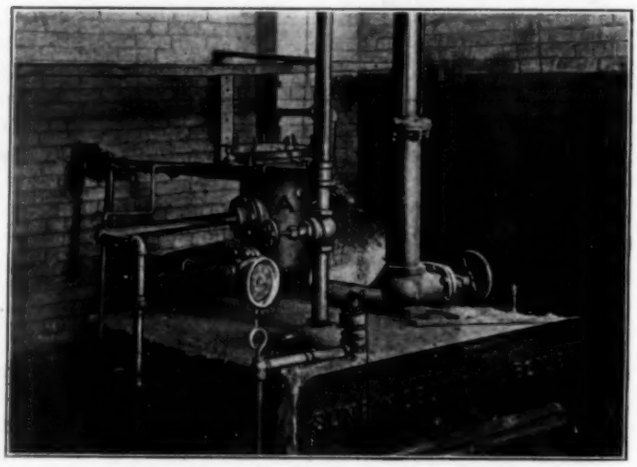
Keeping a Service Tank from Freezing

BY AMOS FERBER

The illustration shows a simple expedient which we adopted to prevent the water in the service tank, on the roof of the factory, from freezing.

Up to two years ago there had been a pipe for admitting live steam directly from the boiler to the tank, and when the fireman did not forget to turn on the steam this worked very well. Sometimes he forgot and then there was trouble. There was a lot of steam wasted anyway.

The device shown at *A* is an old heater, similar to a feed water heater, that had been lying around in some odd corner for a long time, out of service. Our superintendent conceived the idea of setting it up on top of



WATER HEATER FOR SERVICE TANK

the heating boiler, as shown, connecting the coil both top and bottom to the boiler so as to keep a circulation in the coil, and connecting the inlet and outlet to the tank by means of two pipes, one of which should enter the bottom and the other near the top as in the ordinary form of water heating systems.

The device has now been in service for two winters and the tank has not frozen since it was installed. There is nothing to forget as the valves are always open and consequently there is always a current of warm

water ascending to the tank. The cost of installation was but a few hours' work and the cost of operation is so low as to be negligible.

Milling Tapered Wedge Keys with an Automatic Hacksawing Machine

By Harry Flower

Our products call for a great number of tapered wedge keys that are made from $\frac{3}{8}$, $\frac{1}{4}$ and $\frac{5}{8}$-in. round cold-rolled steel. These keys, which are used to hold a collar onto a crankshaft, are 2 to 3 in. long and have a flat milled the whole length of one side, as shown in Fig. 1. We had been milling the tapered flat on these keys with a milling machine, but had been having considerable difficulty in keeping up the holding fixtures, due to the fact that it took such a tremendous strain to hold the pin and keep it from turning under the

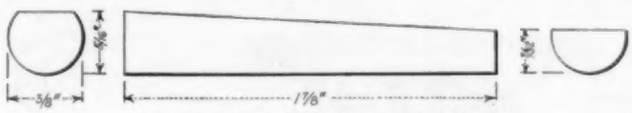


FIG. 1. DIMENSIONS OF KEY

milling cutters that the holding fixture would not stand up very long.

Our superintendent, getting hot about the collar as a result of the tremendous expense of keeping up the holding fixture, hit upon the idea of milling the keys with a hacksawing machine, using a staggered tooth broach in place of a hacksaw blade. He rigged up a No. 5 Marvel automatic high-speed saw for the purpose, and the machine has been running day after day making these keys automatically without any attention whatever from an operator except for the purpose of reloading the magazine.

Front and rear views of the machine in operation are shown in Figs. 2 and 3. The saw frame was cut down to hold a heavy broach $\frac{3}{4}$ in. wide. The broach or cutting tool was made with teeth on both sides so that when one side became dull the tool could be reversed.

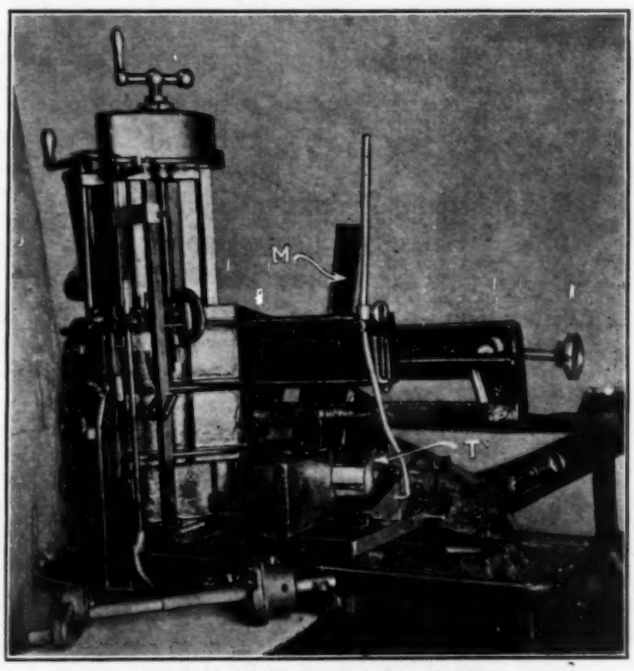


FIG. 2. FRONT VIEW OF MACHINE

A turret *T* was mounted on an angle plate which was clamped to the machine bed in place of the regular vise, and the turret drilled at six equidistant points near the circumference to receive six blank pins. The angle plate was machined at the same angle as the required taper on the key. A ratchet *R* attached to the outer end of the turret shaft was so placed that a pawl *P* actuated by the regular vise lifting rod would turn the turret one-sixth of a revolution and register a blank pin directly below the cutting tool each time the saw

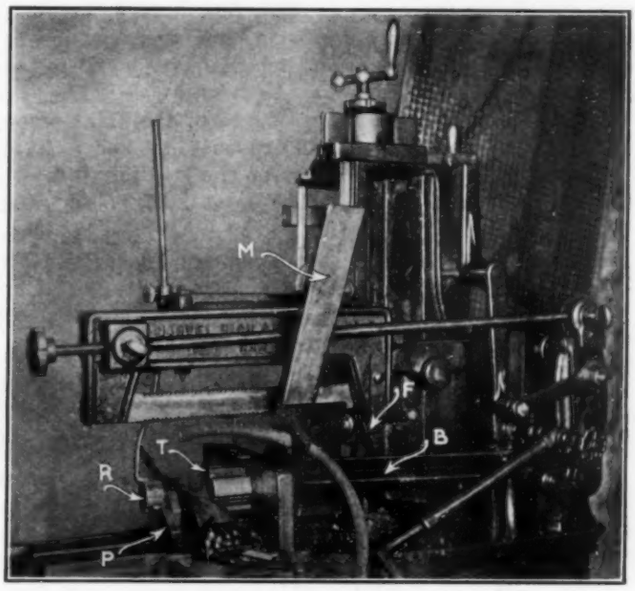


FIG. 3. REAR VIEW OF MACHINE

frame was automatically raised to the top or starting position.

A sheet metal trough *M* was provided as a magazine to hold a number of blank pins. A round rod with two trip dogs attached to it was supported so that it could slide endwise back of the horizontal bracket *B*. When the saw frame comes down to mill the key that is in position below it in the turret, the finger *F* on the rear of the saw frame strikes one of the dogs on the slide rod on the forward motion of the saw frame, driving the rod forward, and pushing the lower blank pin from the magazine into the turret, at the same time discharging a finished key. The return of the saw frame allows finger *F* to engage the other dog on the slide rod and pull the slide or loading rod back toward the rear of the machine to its original position.

How to Find the Area of an Irregular Surface

By Frank Harazim

To find the area of a plane surface of an irregular outline, place the object under a sheet of transparent paper cross-sectioned in $\frac{1}{8}$-in. squares and tack the sheet to the board. Count the number of whole squares that are within the outline; then estimate the fractional parts of the squares cut by the outline and add their sum to the number of whole squares. The result is the area in units of the dimensions of the squares. The smaller the squares of the cross-section paper the more accurate the result. This is not a new method, but needs to be mentioned frequently.

A Rotary Box-Blank Die

By P. H. White

The rotary die herein described is used in cutting blanks from which cardboard boxes are made. The stock used is of different thicknesses, varying from 0.035 to 0.065 in. and comes to the cutting machine in reels weighing on an average 400 lb. The reel of cardboard is mounted on a standard at the rear of the cutting machine, and the end of the roll is started into the machine. The feeding is done by two rollers, the upper one also doing the cutting. The rolls are of the same diameter, and are driven at the same speed by means of a pair of gears having a pitch diameter equal to the diameter of the rolls.

In Fig. 1 is shown the appearance of the blank when it leaves the machine. The score lines *AA* and *CC* are cut through half the thickness of the stock, and determine the width of the box. The score lines *AB*, *AC* and *CD* determine the length of the box. Fig. 2 represents the finished box when folded and pasted together. Fig. 3 shows an assembly of the finished die. The knurling shown is to prevent the cardboard from creeping.

The different parts that go to make up the die are held in place by means of two nuts, shown in Fig. 4. These nuts are made right- and left-hand, so that any slipping between the top and bottom rolls will tend to tighten the nuts. Another function of the nuts is to act as safety rings for the purpose of preventing the two rolls being adjusted too closely together and thus injuring the cutting blades. The diameter of the nuts is made greater than that of the rolls, but smaller than the outside diameter of the circular cutters.

The circular cutters are represented in Fig. 5. The score line *AA*, Fig. 1, is cut by the undercut portion of *A*, Fig. 5, while the portion from the lines *AC* to the ends is cut by the full sized part of the cutter. Cutters *B* and *C* cut out the small portions along the lines *G* and *H*, while *D* trims the outside edges along the lines *BB* and *DD*. It should be noted that there are two of each of these cutters, making eight in all. In machining with cutters *B* and *C*, it is necessary to transfer the cutting edges from front to back at the points where they start to cut out the radii at *A*, *B*, *C* and *D*, Fig. 1. Cutters *B* and *C*, it should be noted, are relieved sufficiently to clear the blank except at the lines *G* and *H*.

In Fig. 6 *A* represents the blades which cut off the ends of the blank. *B* represents the blades which make the cross scoring lines. The blades are held in their respective slots by means of wedges, as shown at *C*.

The blades are carried in the holding rings shown in Figs. 7 and 8. The wedges have $\frac{1}{32}$ in. clearance underneath to insure their binding against the blades rather than resting on the bottoms of the slots.

The narrow ring shown in Fig. 9 carries a short blade similar to *A*, Fig. 6. One of these rings goes at each end just inside of the nut. The function of these blades is to cut up the narrow strip trimmed from the width of the stock as it passes through the rolls. When this narrow strip is not cut up, it sometimes runs out in long lengths which become objectionable.

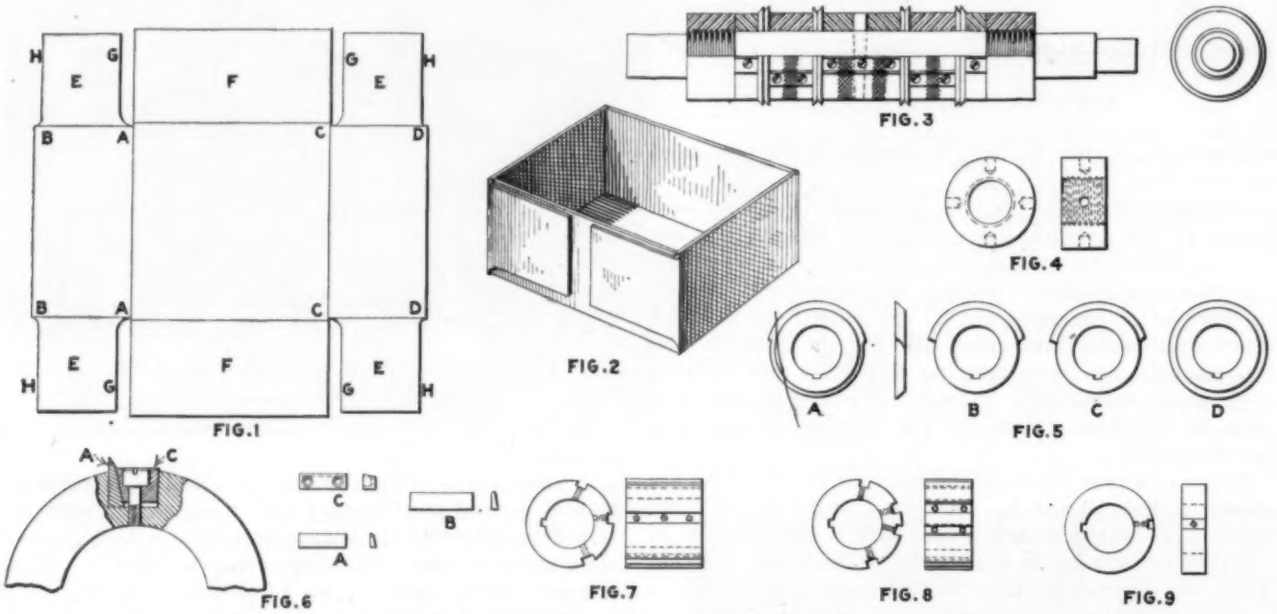


FIG. 1. THE BOX BLANK. FIG. 2. THE FOLDED BOX. FIG. 3. THE ROTARY DIE. FIG. 4. THE END NUT. FIG. 5. THE CIRCULAR CUTTERS. FIG. 6. CUT-OFF BLADES AND WEDGE. FIGS. 7 TO 9. RINGS FOR HOLDING CUT-OFF BLADES

Rebabbitting Bronze-backed Bearings with a Soldering Copper

By Robert Tait

I have read with interest the items appearing in American Machinist from time to time dealing with automotive repairs, as we do a large amount of such work.

One job, which is of frequent recurrence is the rebabbitting of bronze-backed bearings. We had tried many ways of doing this with rather indifferent success until we hit upon the following plan. Using a piece of angle iron as a mold, a quantity of babbitt bars of a convenient size are cast. The bronze shells are carefully cleaned and retinned if necessary and the babbitt applied with a soldering copper, until sufficient metal is built up to admit of boring to size. We have used this method for a good while and have yet to hear

of a bearing in which the babbitt has broken away from the bronze.

In the case of connecting rods, which are tinned directly on the steel forgings without the use of a bronze shell, the same procedure as above is used; after which we locate the rods by the piston-pin hole on an angle plate attached to a milling machine table, and bore and face with an adjustable boring bar in the usual manner.

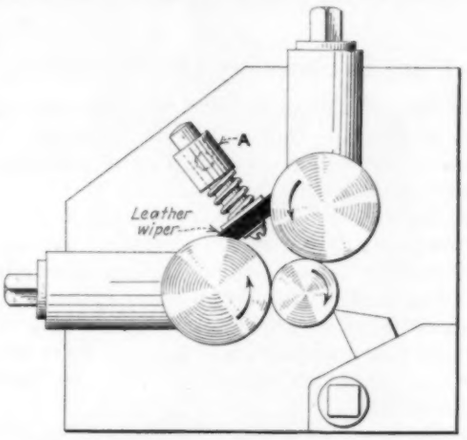
This idea may not be new to most of your readers, but it has proved of value to us, and we are glad to pass it along for consideration.

A Cleaner for the Rollers of Box Tools

BY W. BURR BENNETT

We had been having trouble in our shop from chips that would cling to the rollers of the box tools and mar the work, especially when the material was cast iron. To overcome the trouble the writer devised the roller cleaner shown in the sketch.

The square shouldered stud *A* screws into the face



WIPER FOR ROLLERS OF BOX TOOL

of the box tool. Fitted to the crosshole in the outer end of the stud is the stem of a plunger to the outer face of which is attached a leather wiper to bear upon the rollers, it being held in contact therewith by the pressure of a coil spring surrounding the stem of the plunger.

It was first feared that the pressure of the wiper upon the rollers would prevent the latter from revolving and thus cause flat spots to be worn upon them, but this fear proved groundless. The pressure of the work is so many times greater than that of the wiper that the rollers always revolve.

Different sizes of leather have to be provided to accommodate different settings of the tool.

What Is the Most Economical Belt?

BY S. KELLY

The article by W. F. Schaphorst under the above title, printed on page 256 of AMERICAN MACHINIST, is a timely and instructive one upon a subject to which too little attention is ordinarily given. His handling of the matter would indicate that he had had a lot to do with belts and that he does not share in the general indifference accorded to the belt subject.

Belts running upon smooth surfaced pulleys of either metal, wood, or paper are by no means positive in their action. Unless the belt is unduly tight there will be slippage and consequent loss of power; or, if the belt be sufficiently tight to prevent slippage, there will be excessive friction upon the shaft journals. Since 90 per cent of the power transmitted in this country is by belt, the total loss is enormous.

A very simple and efficient means of overcoming the difficulty and reducing the power loss from slipping belts is to cover all pulleys with a heavy cotton fabric fastened to the surface with cement. If this job is neatly done the pulley surface will present a smooth, unbroken appearance and its balance will not be affected.

The belt shows a tendency to cling to the surface of a pulley so treated much more tenaciously than to the original surface and therefore a belt that would otherwise have to be very tight in order to transmit its quota of power may be run quite slack, with a corresponding lessening of friction upon the bearings.

The power transmitting capacity of pulleys so treated ranges from 30 to 70 per cent greater than that of the same pulleys under the same conditions of speed, width, tension, etc. with uncovered surfaces, and the life of a belt may be increased from 50 to 500 per cent.

A concrete illustration of the possible saving may be drawn from the following example: A steel saw in a structural shop was driven by a 16-in. belt running upon uncovered pulley surfaces. This belt slipped excessively and so rapid was the wear that a belt would last only from 40 to 60 days. The pulleys were covered as above described and the new belt then placed on the drives has now been running for 18 months.

Clearance Grooves for Sliding Fixtures

BY E. F. OAKFORD

In the article on "Tool Engineering" on page 798, Vol. 55, of AMERICAN MACHINIST, there is illustrated (Fig. 255) a sliding fixture in which the clearance at the corners of the guiding strips is obtained by grooves as shown at *A* in Fig. 1.

Such a crude method of obtaining this most necessary clearance deserves the strongest condemnation. The extra cost of machining these grooves is considerable, usually needing a change of tools and always requiring increased time and labor. A more reasonable method of obtaining such clearance is shown in Figs. 2 and 3. The fitting is machined, as in Fig. 3, to leave the corners as sharp as is convenient, using ordinary tools, while the edges of the guiding strips, Fig. 2, are machined to a radius appreciably larger than that of the female portion. When assembled, an entirely satisfactory clearance is secured, combined with maximum cheapness and ease of production.

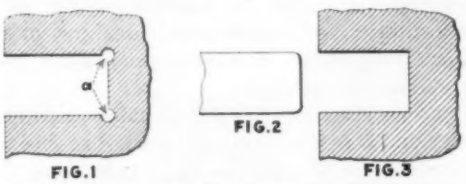


FIG. 1. CLEARANCE GROOVES OBJECTED TO BY THE AUTHOR. FIGS. 2 AND 3. CLEARANCES OBTAINED BY ROUNDING CORNERS OF THE TONGUE

It should be noted that the method of securing this clearance, as shown in the article referred to, cannot be adapted conveniently to any milling process, though such a process can be used for the modified method described here.

Editorial

Conservatism of the Mechanical Engineers

THE members of the American Society of Mechanical Engineers have decided to make haste slowly. At the Atlanta meeting last week where the draft of the new constitution was presented for discussion they decided that it was all-important to provide every safeguard for a continuing policy.

According to the changes in the new constitution affecting the council of the society, the total years of service of those members holding over at each election would have been a minimum of sixteen. Under the existing arrangement this minimum is twenty-seven.

With a membership sixteen thousand strong and still growing, and with an annual business running over six hundred thousand dollars, it is wise for any group of men to take steps to prevent sudden shifts of policy due to rapid changes in the directorate.

There is, of course, the danger of reactionary tendencies in men too long in office but with approximately one third of the council members being replaced every year this danger seems much less than the other.

We feel that the Mechanical Engineers are to be congratulated on their sound judgment. They are on the eve of accomplishing big things and need a well-balanced fly wheel to hold them steady.

Standardization Through Trade Associations

ACTIVE work on the standardization of products throughout industry in general probably began during the late war when the Conservation Division of the War Industries Board asked each concern and each industry to co-operate in the elimination of unnecessary lines. The advantages incident to standardization of products and elimination of unnecessary designs are self-evident. Very frequently, however, the means of obtaining them are not so evident.

Of course, any one concern can standardize within its own organization, but the greatest work has been accomplished by trade associations that represent a whole industry or branch of one. Because of their work on standardization, trade associations are now receiving much attention and favorable comment from the Department of Commerce. Most of this work relates rather to simplification of variety, than to standardization as based on engineering principles.

The machine industry can learn from what has been done in related industries, and even in those that are far removed from it. The fact that an association representing the manufacturers of over 90 per cent of the output of farm implements in this country has been able to eliminate 955 models of farm machinery and to retain only 137, is very significant of the possibilities in this line.

If a manufacturer of writing paper can save hundreds of thousands of dollars a year by simplication in the variety of his products, and if a fertilizer manufacturer can cut the number of formulas used to only a fractional part of those formerly employed, there is certainly opportunity for similar work in the machine industry, where so much detail is involved. Common building brick, umbrellas, wood wheels and numerous other products have been standardized by the active influence of trade associations, and the work is so new that the biggest developments are still to be expected.

The idea of elimination of the unnecessary items and concentration on the important ones is so well worth developing that it might almost be taken as the motto of trade associations. The results accomplished have been so favorable and the saving for every one concerned so marked, that the work deserves the attention of every manufacturer. Time and money put into intelligent standardization will pay big dividends in the end.

Care in Starting Idle Machines

BUSINESS is picking up—and it is bringing its problems to machine tool builders and others. One of these has to do with the starting up of machinery that has been standing idle for some time. Of great importance is the matter of thorough lubrication. It is many times equally important to remove old oil.

In one specific instance that has come to our notice, a machine had been delivered two years ago but had never been run owing to lack of orders. On starting it up one of the main bearings had seized and the users demanded, through the agent, the replacing of the shaft and bearing without cost.

It hardly requires a Sherlock Holmes to determine why the bearing seized. Oil in bearings does not remain a good lubricant after standing idle for two years. In all probability it forms a residue or gum which takes up most of the space provided for the film of lubricating oil. This gum is not a lubricant but makes a highly frictional surface. Oil, even if introduced into the bearing, could hardly lubricate it properly under these circumstances. Such a bearing is almost certain to seize when put to work.

When a machine has been standing idle for any length of time, the lubrication of its bearings becomes a problem requiring careful attention. The whole lubricating system, if it has one, should be not only drained but thoroughly flushed out with kerosene to cut out any gum which may have accumulated. Care should be taken that every bearing is free to move and that it has a good supply of new lubricant.

It is a good plan to turn over by hand a machine which has been standing idle to make sure that it is free in every bearing. If it turns freely, run it by power but without load, until you are convinced that it is all right to put to work. A little precaution of this kind will save time, trouble and a tendency to dispute with the maker as to the machine's being defective.

Now is the time for builders of machine tools to be on their guard for claims for replacements due to the cause mentioned. Now is the time for users of machinery to use good judgment in starting up machinery so as to avoid unnecessary and exasperating delays.

Shop Equipment News

Bright Internal Grinding Machine

An internal grinding machine of unique design has recently been placed on the market by the Garvin Machine Co., New York, N. Y. The machine is the

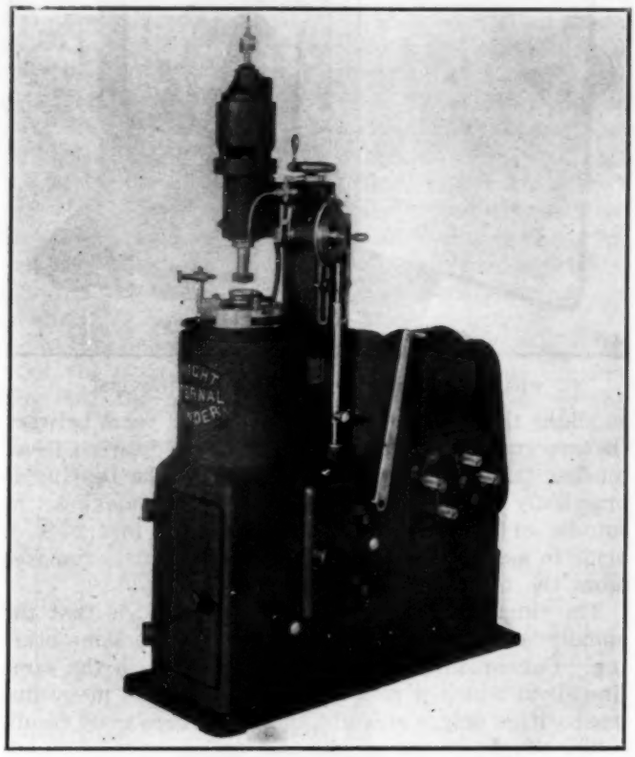


FIG. 1. BRIGHT INTERNAL GRINDING MACHINE

invention of Fred E. Bright, who is well known in the machine industry in both this and European countries. It is intended primarily for manufacturing operations; it grinds cylindrical holes only. A view of the control side is shown in Fig. 1, and of the back of the machine in Fig. 2.

The new fundamental feature (patented in many countries) is the revolving and reciprocating of the work carrying spindle in one bearing, eliminating the necessity for exact alignment of it with other essential parts of the machine. Due to this fact great accuracy and efficiency are possible in the finishing of straight round holes.

The grinding wheel spindle is directly driven, so that slowing down due to belt slippage is avoided, and the wheel speed can be continuously and accurately maintained. Other features such as the simplicity of control and the accessibility of the work, are certainly worthy of note.

Both the wheel spindle and the work spindle are placed vertically. The motor driving wheel is at the top of the machine; a separate motor, located at the rear, is provided to drive the work and to operate the feed mechanism. The capacity of the No. 2 machine is rated as 4 x 4 in. A swing of 11 in. is permissible inside the water guard, the latter a simple, adequate part of the machine.

Because of the vertical position of the spindle, the floor space required is considerably less than that of a horizontal-spindle machine of like capacity. Since the machine is self-contained, no belts nor countershafts are required. This reduces the cost of maintenance and allows the easy removal of the machine from one spot to another. The floor space is only 20 x 45 in. The machine is 63 in. in height, with the wheelhead in the raised position; the chuck plate is 38⅞ in. above the floor in its central position. The total weight of the machine is only 1,250 lb., but is said to be unusually rigid and substantial for its range of work.

The motor driving the wheel spindle is of the induction type, and easily removable from the housing of the spindle. The absence of brushes enables rotation at a very high speed. Although the motor generates 1½ hp., the outside diameter of its housing is only 5¾ in. The windings are cooled by a draft of air taken in at the bottom of the housing and expelled at the top. The armature shaft runs on one double-row ball bearing at the top.

The wheel spindle is mounted in double-row ball bearings, one at the top and one at the bottom. These bearings are adjustable to provide for taking up wear. At the bottom of the spindle, extensions to suit the type of work being done can be mounted. The arm-

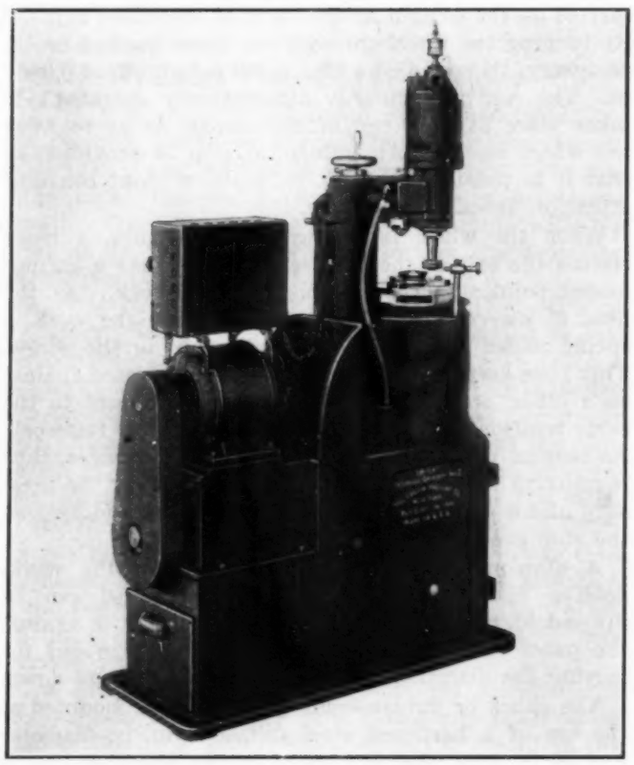


FIG. 2. REAR VIEW OF BRIGHT MACHINE

ature shaft drives the wheel spindle through a tongue-and-groove coupling. Thus, when in operation, the two shafts rotate as a unit on three ball bearings. No vibration is perceptible due to the rotation of the parts.

The oil from the cup at the top of the head drips down so as to lubricate the top bearing of the armature. It is prevented from entering the windings of the motor, and is carried through a duct to the bearings of the wheel spindle.

In order to change the speed of the wheel spindle, the frequency of the current driving the motor must be changed. The frequency-changing device ordinarily employed consists essentially of a variable-speed d.c. motor driving an alternator. It is thus possible, by merely changing the resistance in the field circuit of the d.c. motor, to vary the number of cycles, and consequently the speed of the spindle motor. At 120 cycles, or the minimum speed, the spindle motor runs at 7,500 r.p.m.; at 200 cycles, the speed is 12,000 r.p.m., which is the maximum, these and intermediate speeds proving to be effective because of their maintenance at predetermined rate without slippage. Where a single grinding machine is used, a small frequency changing unit may be employed. Where a battery of the machines is operated, one installation may serve for the entire group.

The wheel spindle and its motor are mounted on a yoke that pivots about the supporting column. This column can be lifted by means of a lever at the right side of the machine, so that the wheel clears the work. After the wheel has been raised, the whole head can be swung to the left of the machine, so as to provide clearance for removal and replacement of the work. The column consists of two telescoping parts, whose relative position is controlled by means of a screw operated by the handwheel at the top. It is thus possible to vary the length of the column, and, consequently, the height of the wheelhead.

A feed screw having a large graduated wheel is carried on the column at the right of the wheel spindle. By turning the wheel through one space marked on its periphery, the grinding wheel is fed a distance of 0.0001 in. The feed is ordinarily automatically operated. It takes place at each end of the stroke, so as to wear the wheel evenly. An automatic stop is provided, so that it is possible to work to depth without constant attention from the operator.

When the wheel is swung over the work, a block strikes the end of the feed screw, which has a spring-loaded point, in order to cushion the shock. As the head is lowered to bring the wheel inside the work, a spring-loaded yoke passes behind a pin in the screw. This yoke keeps the screw and the block pressed against each other, so that the wheel may be brought to the same position each time that it is swung over the work. As soon as the head is lifted, the yoke disengages, thus permitting the operator to swing the head by the pressure of his left hand away from the work and against the stop provided to limit the swing.

A diamond is fixed on the housing of the work-holding chuck, so that the abrasive wheel can be dressed by merely lowering the head when it is against the outer stop. A screw adjustment is provided for moving the diamond forward as the wheel wears down.

The chuck or fixture holding the work is mounted at the top of a hardened steel spindle 3 in. in diameter and 20 in. long, that is carried in two phosphor-bronze bearings fixed in a housing that can be easily removed. Due to the vertical position of the spindle, it revolves in a perfectly balanced film of oil in each bearing. The only time when there is any lateral pressure is when the grinding wheel touches the work. This force is

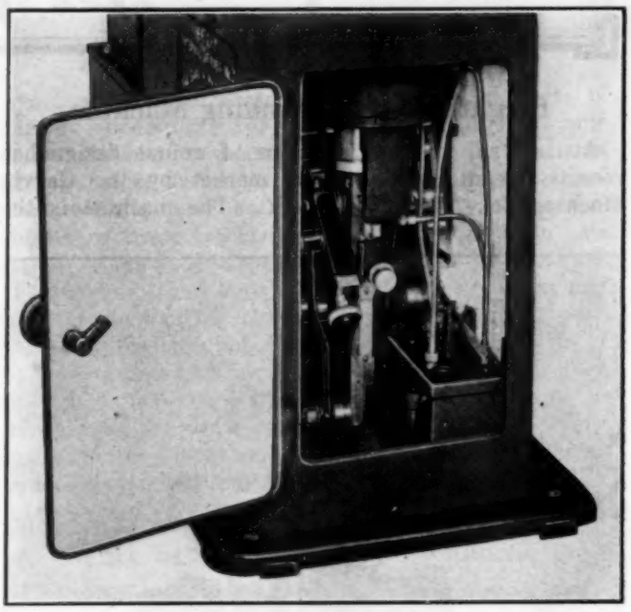


FIG. 3. STROKE ADJUSTING MECHANISM

so slight that it does not squeeze the oil from between the two surfaces. Since the metal of the bearing never touches that of the spindle, the life of the bearing is practically unlimited. The reason for making the spindle of hardened steel is to prevent injury to it prior to assemblage, or in the event that it is removed from the machine.

The chief feature, previously mentioned, is that the spindle both rotates and reciprocates in the same bearing. Consequently, the work reciprocates in the same line about which it rotates. Since the wheel maintains one position only, a straight and round bore must result.

The weight of the spindle and work is carried on one ¾-in. ball at the bottom. This ball rests in a small pocket that allows sufficient clearance for it to travel eccentrically about the center line of the spindle, so that it wears uniformly. Removable hardened steel disks are provided both above and below the ball.

The spindle is driven by means of three flexible steel keys, mounted in a bevel gear running on a separate bearing with clearance around the lower end of the spindle. As the spindle reciprocates, these keys slide in vertical splines. The advantage of this method of drive is that no side pressure is placed on the spindle, as must necessarily occur when it is driven by means of a belt. The bevel gear is mounted on ball bearings and is driven by a pinion carried on a shaft, also running in ball bearings, and connected directly to the speed-change gear box at the rear of the machine.

The work spindle is lubricated by force feed from the small pump, Fig. 3, placed in the front of the base and driven by the stroke mechanism. The oil is driven to the top of the top bearing, and works down through the two bearings to the bottom of the spindle, where it drops off into a small cup, from which it is led back to the tank of the oil pump. Some of the oil is diverted to the bevel gears, so that both they and their bearings run in oil.

The mechanism that causes the work spindle to recip-

rocate is driven by a separate shaft from the feed box at the rear of the machine. This shaft drives a cam through a worm and worm gear. The purpose of the cam is to so operate a lever and a connecting rod fastened to the bottom of the shaft carrying the ball which supports the spindle, that the spindle will move at uniform speed from one end of its travel to the other, or at a variable speed according to the form given the cam. The stroke of the spindle can be controlled from nothing up to the maximum while the machine is running, by merely turning a small knurled screw. Fig. 3 shows the mechanism by which reciprocation is controlled.

By the use of both a double and a single-lobe cam on the camshaft, twice the number of reciprocating movements provided for by the feed box can be obtained. Of course, only one cam is in operation at a time. The speed of rotation of the spindle is 100 to 385 r.p.m., in five steps. The ten reciprocating speeds permit of from 4 to 48 strokes per minute.

The total weight of the reciprocating parts is balanced by means of a counterweight inside the base. However, the spindle is slightly heavier than the counterweight, so that it drops of its own accord and keeps the follower against the cam. The motion of the cam follower is only one-third that of the spindle.

By the removal of two bars that pass through the base, the entire mechanism for operating and controlling both the rotating and reciprocating action of the

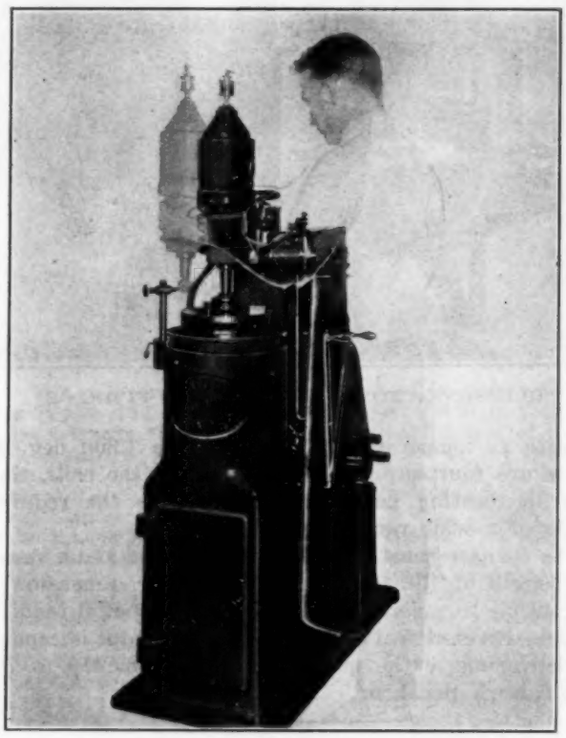


FIG. 4. POSITIONS OF HEAD AND OPERATOR

work spindle can be removed as a unit through the door in the front of the base.

The 1½-hp. motor at the rear of the machine drives by means of an inclosed silent chain the feed box on which it is mounted. This feed box is of the automobile type, and has three shafts in each compartment. It really is two separate boxes, the upper one driving the mechanism for rotating the spindle, and the lower one that for reciprocating it. Five changes of speed operated by two hand levers are provided in each box. All gear-box shafts are mounted on ball bearings, and no gears are in mesh when not actually driving. The gears run in oil. A brake is provided at the rear end of the main drive shaft, so as to stop the motion of the work spindle as soon as the wheel is lifted from the work.

The rear of the base contains a tank for holding the cutting lubricant, as well as a pump for circulating it to the nozzle at the head. The piping is inclosed and the water tank is easily removable for inspection and cleaning. When the wheel is lowered to the work to start the cut, the cooling lubricant is automatically turned on, and it is turned off when the work spindle is withdrawn.

The guard surrounding the work chuck can be easily raised and lowered by the operator. The water thrown from the work runs down on the inside of it, but it is prevented from entering the bearings of the work spindle by a cylindrical brass guard secured to the bottom of the chuck plate. The water and grit thus pass between the two guards and into an annular chamber in the housing, the bottom of which chamber slants to one side of the machine, where a drain leads directly to the tank in the base.

To start the machine, the lever on the right is pushed backward. This action first lowers the wheel to the work. Continued movement of the lever disengages the brake mechanism and engages the clutch at the feed box. When stopping the machine, the forward movement of the lever throws out the clutch, engages the brake and then raises the head.

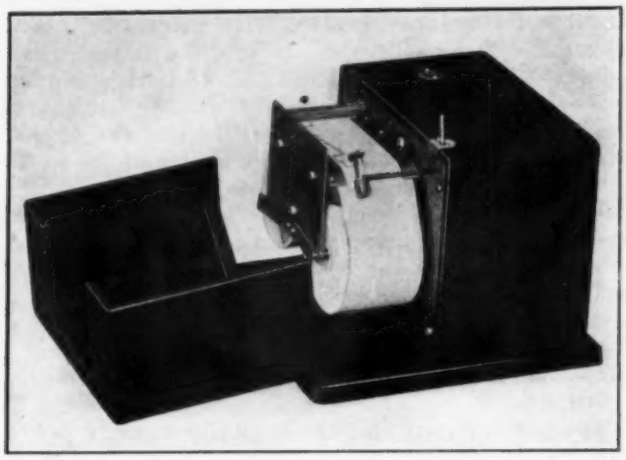
The work is in plain view and very easily accessible to the operator, whose position for operating the various movements is shown in Fig. 4. In order to dress the wheel, vertical reciprocating movement is given it by operating the lever back and forth at the front end of its stroke. The work spindle does not rotate nor reciprocate during this operation.

Williams Time-Study Machine

H. H. Williams, 1613 Chestnut St., Philadelphia, Pa., has recently placed on the market a machine for use when taking observations in time-study work. The machine times the operations and makes a permanent record. The illustration shows the machine with the cover at the rear of it removed, so that the recording mechanism can be seen.

A strip of paper is moved by a positive drive at a uniform rate of speed that can be regulated to suit the conditions. A pen is so mounted as to trace a line on the moving strip of paper. This pen is caused to move back and forth across the strip by two finger keys. The observer presses one of the keys at the completion of each element of the cycle during an observation, so that the pen moves by steps across the strip. At the end of the cycle, the pen is returned to its starting position by pressure on the other key. It is thus not necessary for the observer to give close attention to the machine, and he can keep his eyes on the worker continuously, so as to observe his movements in performing an operation.

The graph or record that is obtained gives all the data necessary for filling in a time-study observation sheet of the usual type. The data in the record on the strip can be transferred to such a sheet at the con-



WILLIAMS TIME-STUDY MACHINE

venience of the observer. The length of time elapsing between each step or jump of the pen can be read on the strip by means of a decimally divided scale when determining the time of each movement.

The motor is spring-driven clock work, and is sturdy enough to give continuous operation. Since the machine is not dependable on any outside power, it can be easily moved to any desired position. The machine is more accurate than a stop watch, as observations of 0.001 min. can be recorded. Twenty-four steps or elements are obtainable on the moving strip of paper. The machine is 8 x 8 in. square and 6½ in. high. It weighs 9½ lb., so that it can be very easily carried to the place where it is to be used.

Allen "Bay State" Wrench Set

The Allen Manufacturing Co., Hartford, Conn., has placed on the market a set of square and hexagon socket wrenches designed expressly for automobile and garage work. The set comprises reversible ratchet wrench, universal joint, extension bar, screwdriver and twelve sockets ranging in size from $\frac{7}{16}$ to $\frac{1}{8}$ in. hexagon, and including $\frac{3}{4}$, $\frac{1}{2}$ and $\frac{3}{8}$ in. square sockets. The sockets are made by the same process of drawing as

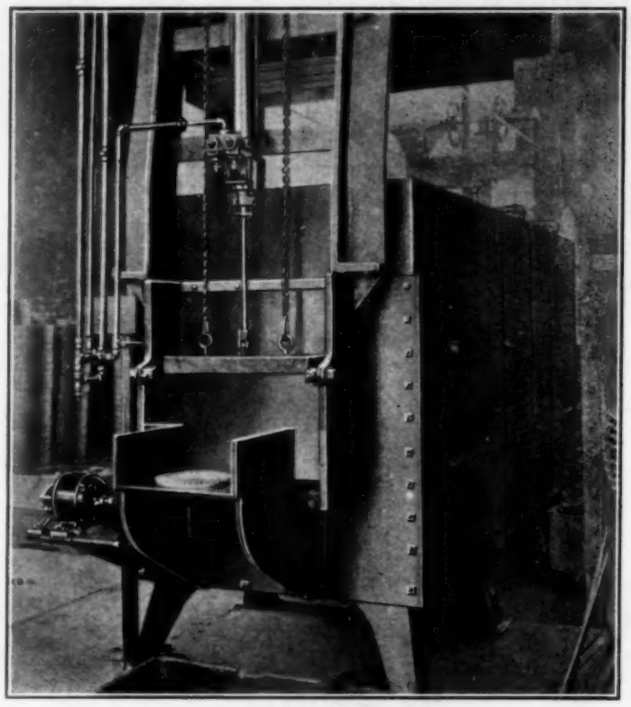
ALLEN "BAY STATE" WRENCH SET

are the Allen hollow head setscrews and subjected to the same heat-treatment. They are claimed to be proof against breakage. The set is put up in a hardwood case, as shown in the accompanying illustration, and it is designated as the No. 19 box set.

Gleason Automatic Hardening Furnace

The American Industrial Furnace Corporation, 10 Post Office Square, Boston, Mass., has undertaken the handling and installation, for commercial purposes, of the electric furnace developed by the Gleason Works of Rochester, N. Y., for hardening gears for automobile transmissions. An end view of the furnace is shown in the accompanying illustration. The control panel is mounted on the side not shown.

The furnace in every way conforms to the latest engineering practice, with respect to electric furnaces, and is adaptable to the hardening of all small and medium size machine parts. It is automatic and continuous in action. The hearth is made up of a series of "thermalloy" rolls, these rolls being geared together and driven by a variable-speed motor. It is designed to



GLEASON AUTOMATIC HARDENING FURNACE

operate at temperatures from 1,000 to 1,800 deg. F. There are fourteen changes of speed to the rolls, thus insuring heating periods to conform to the requirements of a wide range of work.

The furnace hearth has a width of 17 in. and a standard length of 132 in., though this latter dimension is susceptible to variation in order to meet special requirements. Its electrical capacity is 65 kw. and it is capable of delivering to the quenching tank from 450 to 700 lb. of work per hour.

A Time Saver

BY FRANK HARAZIM

If we cut the tables of contents out of all the magazines and bind them together between two stiff covers with brass paper fasteners, we will not have to look through all the magazines that are filed away to find a reference. Looking through a magazine is bothersome, especially when the table of contents is located several pages from the front as it is in some cases.

News Section

Little Improvement in Call for Freight Equipment

Freight cars idle because of business conditions totaled 529,658 cars on April 30, compared with 529,884 on April 23, or a decrease of 226 cars, according to reports just received from the railroads of the United States by the car service division of the American Railway Association.

Of that total, 371,538 were surplus freight cars, that is cars in good repairs in excess of current freight requirements, while the remaining 158,120 were freight cars in need of repairs in excess of the normal number unfit for service.

Surplus coal cars totaled 235,077, an increase of 5,185 within a week, while an increase of 1,718 was reported for coke cars within that period, bringing the total to 5,387. Surplus box cars numbered 94,653, a decrease of 3,753 cars since April 23. Reports showed 15,191 surplus stock cars, which was a decrease of 923 within a week. Miscellaneous freight cars also showed a decrease of 1,449 within the same time, the total being 4,891.

Foreign Trade Lists Available for Manufacturers

The commercial intelligence division of the Department of Commerce has recently compiled a number of new and revised trade lists from information submitted by American consuls and trade commissioners. A number of these lists are starred to indicate the relative size and importance of each firm in its community. The nationality of the firms is also indicated. These lists have been mimeographed and copies can be obtained from the bureau or its district and co-operative offices by referring to the title and file number:

Motor cars, trucks, tires, and accessories — Importers and dealers — Belgium EUR-1014-A
Bicycles, motor cycles, and accessories—Importers and dealers—Norway EUR-9002-A
Motor cars and trucks—Manufacturers—Spain. EUR-11015
Agricultural implements and machinery — Importers—Sweden EUR-12012-A
Automotive products — Importers and dealers —Sweden EUR-12034
Motor cars and trucks—Manufacturers—Austria EUR-15002
Motor vehicles and accessories—Importers and dealers — Siam..... FE-17002-B
Motor cars and accessories — British Malaysia FE-18002-B
Motor vehicles and accessories—Importers and dealers—Ceylon FE-22003-B
Hardware importers and dealers — Venezuela.. LA-22004-B

Substitute for Stanley Patent Bill

Realizing that compulsory working of patents along the lines suggested in the Stanley bill is too strongly opposed to permit of its becoming a law, Henry Howard, president of the American Institute of Chemical Engineers, and chariman of the executive committee of the Manufacturing Chemists' Association, has suggested a substitute. The substitute has been accepted by Senator Stanley. The text of Mr. Howard's bill provides that two years after the issuance of any United States patent, or at any time after the expiration of that period, if it is shown that the invention covered by such patent is being worked in a foreign country, and that the owner has failed to work it in the United States, and has refused to grant licenses upon such reasonable terms as would make it practicable to practice the patent in the United States, then on the petition of any reputable American citizen, corporation or partnership, exclusive jurisdiction is granted to any United States circuit court of appeals in the district to investigate all the pertinent facts, and the burden of proof shall be upon the owner of the patent to show that he has been and is using reasonable diligence in bringing about the bona fide working of said patent on a scale sufficient to show a bona fide establishment of the industry.

Upon failure to make such showing, the court shall order a non exclusive license granted to the petitioner upon such terms as it shall determine to be equitable.

Academy of Political Science Studies Europe

The part which America is playing and will continue to play, in the rehabilitation of Europe, was the general topic of the twenty-sixth annual meeting of the Academy of Political Science, held on May 12 and 13, at Philadelphia.

The subject was debated and discussed from all sides by speakers from all walks of life. Legislators, executives, ambassadors of foreign nations and educators all joined thoughts in this all absorbing question.

The first session dealt with the industrial and financial situation and its remedies. Speakers included the governmental representatives of the important continental European countries.

Another session took up the question of the relation of America's prosperity to the rehabilitation of Europe. Speakers included Senator Sterling, of South Dakota; Albert Strauss, of New York; S. M. Vauclain, of Philadelphia; W. S. Culbertson, of Washington and Dr. George B. Roorbach of the Department of Commerce.

The European debts to the United States were discussed at another meeting. Senator Owen of Oklahoma, and E. R. Platt, of the Federal Reserve Board, were the speakers.

Southern Metal Trades in Savannah

The annual convention of the Southern Metal Trades Association will be held on June 19 and 20, at the Hotel Savannah, Savannah, Ga. Gus F. Meehan, of the Ross-Meehan Foundry Co., of Chattanooga, president of the Association, will preside.

While the program for the convention has not as yet been completed, there will be addresses on technical subjects and on the general business situation as it affects the metal trades industries of the South. One speaker will be Horace Lanier, of the West Point Iron Works, of West Point, Ga.; there will also be an address by J. R. McWane, president of the McWane Pipe Co., of Birmingham.

Weights and Measures Conference Next Week in Washington

The Fifteenth Annual Conference on Weights and Measures will be held at the Bureau of Standards at Washington, May 23, 24, 25 and 26. These conferences are attended by government officials interested in weights and measures and by weights and measures officials of states, cities and counties. The sessions are also attended by manufacturers of apparatus and by representatives of industries interested in the general subject. A feature of each of these conferences is the display of manufacturers' exhibits of weighing and measuring apparatus.

The program includes an address by the Secretary of Commerce. C. A. Briggs, of the Bureau of Standards' staff, has taken as his subject "The Metric System: How Would it Be Put Into Effect?" H. W. Bearce, also an official of the Bureau of Standards, will discuss "The Fundamental Standard of Length." John N. Mackall, the chairman of the Maryland State Roads Commission, will point out how portable weighing devices can be used to protect highways. George Warner, chief inspector of weights and measures of Wisconsin, will discuss equipment for testing heavy capacity scales. Other speakers scheduled to appear include: William F. Cluett, chief deputy inspector of weights and measures, of Chicago; J. J. Cummings, chief inspector division of standards, State of Massachusetts; W. T. White, director, Bureau of Weights and Measures, State of New York; Representative Albert H. Vestal, chairman, Committee on Coinage, Weights and Measures, House of Representatives; W. B. McGrady, chief, Bureau of Standards, State of Pennsylvania; P. C. Brooks, president, Scale and Balance Manufacturers' Association; J. J. Holwell, commissioner, Mayor's Bureau of Weights and Measures, City of New York; and John M. Mote, inspector of weights and measures, State of Ohio.

Ninth National Foreign Trade Convention

Outlook for Distribution of American Products Abroad Discussed by Experts—Transportation and Exchange Problems Studied

The Ninth National Foreign Trade Convention held its sessions in Philadelphia at the Academy of Music, May 10 to 12 inclusive. The first day's program included discussions on "A Foreign Loan Policy That Will Enable Idle Factors to Get Work," by J. T. Holdsworth; and "A Practical Method of Putting Our Surplus Gold to Work in Financing Foreign Trade," by Julius H. Barnes. These subjects were discussed from the standpoint of general farm products, manufactures, cotton and the foreign trade merchant.

"The Factor of Depreciated Currency" was discussed by Chas. M. Muchnic, vice-president of the American Locomotive Sales Corporation, who has just returned from an extensive trip in Continental Europe. He said in part:

"There are vast potential demands for all kinds of our products and there are in Europe vast potential means for production and the creation of wealth and consequently of purchasing power or capacity. What is required is faith and confidence in them and the supply of the necessary capital to hasten their general industrial revival. Before the world can again become a large purchaser of our manufactured products we must see a Europe prosperous, busy, producing; the sale of our manufactured products to Europe will follow the sale of our foodstuffs, copper, cotton and other semi-manufactured products.

Europe Not Prosperous

"The present depression in our export trade is not due to German, Austrian, Belgian, French or British competition but to a world lack of purchasing power. German exports, in spite of its depreciated currency, are, according to Dr. Walter Rathenau, only 25 per cent, of its pre-war records. There is unemployment in Belgium and in England; and French industry is largely engaged in the reconstruction of its devastated territories and industries," continued Mr. Muchnic.

"It is interesting to note that while in England, France, Belgium and in the United States wages and costs of living have been materially reduced during the year 1921, and the tendency is for still further downward readjustment; in Austria the reverse has taken place. I was quite surprised to find during my recent visit to Vienna that the costs of practically everything was from fifty per cent to one hundred per cent more than in Germany and nearly as costly as in London, Paris or New York. Austria reached the natural or the gold basis of cost of production. When we bear in mind that in the cost of production of any article in any part of the world enter, first, cost of the raw materials, second, cost of labor which is dependent on the cost of food, shelter and clothing, and third, the cost of plant and depreciation, we inevitably come to the conclusion that the costs of production of all similar manufactured products in all parts of the world must eventually be equalized on a gold basis with possibly the same differentials between various countries that existed before the war."

The other addresses of the session were "Why We Must Have Foreign Trade," by James S. Alexander and "The Effect of High Taxation on Exchange," by J. C. Ainsworth.

The attack on our educational system by Dr. R. S. McElwee, Dean of the School of Foreign Service at Georgetown University attracted attention. Among other things Dr. McElwee stated that the deficiency in knowledge of modern languages, place geography, English composition, beaux arts and the principles of economics was deplorable.

Methods All Wrong

"The deficiency in modern languages is too well known. It seems that all language teaching, almost without exception, is approached from the wrong angle in our national language teaching. Until any individual has mastered the spoken language to a sufficient extent to have some feeling for the language to have it ring in his ears, it seems to me almost worse than useless to drag him through the very metriculous refinements of grammar and difficult classical literature. On the other hand, if a student can read the daily papers and magazines and speak with a good accent and in the usual phrases and idioms, not just words, he can be brought to feel the actual living language of a people—as they use it in their daily lives of business, religion and pleasure. We commence at the wrong end—for instance, imagine teaching a Frenchman English by beginning with a minute examination of all the finest phases of grammatical construction, by learning columns of isolated words and then a text from Shakespeare, Milton, or Browning.

"The knowledge of Geography of high school and college graduates alike, who enter the School of Foreign Service, is almost entirely a cipher. We have found it necessary to put in a clause in the Catalogue to the effect that, 'Before graduation candidates for certificates or degrees must pass a special examination in geography, and that no student who is deficient in Place Geography will be graduated.'"

The topic for the main session of the second day concerned shipping in its various forms. The topics were: "The American Merchant Marine," by W. C. Conlen; "Inland Waterways as Developers of Traffic," by W. H. Stevenson; "Shipbuilding Prospects," by J. I. Ackerman; and "Marine Insurance," by Charles R. Page. The question of transportation costs was discussed by William H. Stevenson, president of the Lake Erie & Ohio River Canal Board of Pennsylvania, as follows:

"At the present time the most important business question to be settled for the American people is that of the early provision of cheap, regular and adequate transportation facilities.

"We cannot hope to properly meet foreign competition for exports unless we have a much lower rate for our products to our coasts, for we have to contend with the much cheaper foreign labor within other countries and also with cheaper carriage on foreign ships, as well as the shorter hauls to their seaports on the internal waterways of other countries.

"The figures for March, 1922, show that while our exports were $55,000,000 less than for March, 1921, our imports were $6,000,000 greater. As I have said, our capabilities for production at present are much greater than the demand for our products, and we must therefore greatly increase our foreign trade. We realize now that the saying that 'no one can live unto himself alone' applies with even greater force in the case of nations and so it is necessary for us to cultivate as much as possible our trade relations with other countries.

"The railroads thus being unable to adequately supply the cheap and prompt transportation from the interior to the coasts so requisite for the securing of our proper share of the foreign trade, to what other agency must we look?

"The one great vital connecting link in this nation-wide system of waterways is the Lake Erie and Ohio River Canal. This will connect the Ohio River with Lake Erie.

"The canal with double locks will have a capacity of at least 76,000,000 tons annually. Great industries of the district have already specifically promised it 50,000,000 tons of traffic, five times the traffic on the Panama Canal, and the smaller ones will supply an equal amount. The canal will traverse the greatest tonnage district in the world, through which there has been moved about 400,000,000 tons in one year. Every ten years the traffic has doubled. So you can see the vast possibilities of this waterway, the bulk of the traffic on which will be iron ore coming south and coal going north. Of both these materials there are supplies to last four hundred years."

Ocean Carriage and Marine Insurance

Under the general heading of "Ocean Carriage," W. H. La Boyteaux presented a paper on the vital points in marine insurance policies. He said in part:

"Although in the United States all insurance companies are subject to state regulation and supervision in respect to their financial status, this, however, does not prevent insolvency, and is no protection against bad management. The 'morale of the company is quite as important as the financial position.'

"Great care should be taken in the placing of marine insurance in foreign markets," continued Mr. La Boyteaux. "The English market is generally recognized as a world's market. For years it has done a world-wide business. Orders for marine insurance are sent there daily in large volume from every country in the world. The capacity of the market is almost, if not quite, as large as the combined capacity of all the outside markets. Its underwriters

have realized the necessity of conducting their affairs on broad and liberal lines and have established an enviable reputation in respect to security and fair dealing. The marine insurer doing business in the United States is the equal of the insurers in England in every way. Also, that entirely apart from sentimental considerations many business reasons exist why American merchants should always give every preference to the American market. This market deserves your loyal support, and that it will get it I have no doubt.

"The marine insurance policy is the contract between the insurer and the insured. The protection afforded by the policy depends entirely upon its terms just as in any other contract. It may furnish a broad and comprehensive protection, or a narrow and restricted one. It is a contract dealing with a complicated subject requiring special knowledge of the rules of law laid down by the courts and of established customs and usages. Few who take out marine policies will trust themselves to make their own contracts with the insurer. They want expert advice and guidance, and for this they go to a broker whose business it is to act for the assured and upon whom they can depend to prepare and negotiate with insurers a contract suited to their needs. There are many such brokers who are not the agent of the companies but act entirely as expert advisers to the buyers of insurance in all matters pertaining thereto, including the handling of their losses.

"The cost is important, but the character of the protection and the security is more so. If you are buying protection you want good, conservative protection,—Class A bonds, not speculative security. The first cost may be slightly higher, but the final cost is less."

South American Business

At the same time another group discussed market conditions abroad, these including "European Business," by C. J. Warren; "South American Business," by F. de St. Phalle; and "Far Eastern Business," by E. G. Anderson. Regarding South America, Mr. de St. Phalle said:

"While South Americans do trade with Germany, they have experienced many disappointments connected with late deliveries, inferior material, and, recently, by increases in invoice values of accepted prices. This tends to bring about greater consideration and better feeling towards the United States.

"The future holds out bright prospects for South America and for the United States. South America will develop at an increasing rate because it is the most attractive and richest of the thinly populated sections available. In addition to the future Development of South America being greater, a larger proportion of this development will be financed and carried out with the assistance of the United States. Economic factors governing the movements of exchange are now better understood in South America and the many loans recently issued from New York to South American countries, coupled with the rising tendency of exchange, have greatly improved the feeling. In the future South America looks to increasing growth carried out to an increasing extent with the assistance of American financial, engineering and business co-operation, all of which is being prepared for at this time.

"With the general recovery of trade, South American exchanges may be expected to rise; some of them have already done so materially. The Argentine will unquestionably return to gold exchange within a comparatively short time. The fall of exchange usually caused by excessive buying and insufficient selling carries within itself its own remedy. By cutting down the country's buying power it reduces imports and lowers prevailing wages by comparison with outside standards which should in time foster exports. The reason for the activity of the copper mines in Chile while the mines in the United States were idle, was the low cost of Chilean labor in terms of gold."

The Exchange Situation

The last day had a very full program beginning with the "Interest of Agriculture in Foreign Trade," by Harvey J. Sconce; "Need for Imports to Pay for Exports," by Walter Lichenstein; "Factors That Will Help the Exchange Situation," by Fred I. Kent; and "A Foreign Trade Policy for Americans," by James A. Farrell. Regarding exchange Mr. Kent offered the following suggestions:

Co-operation with Russia along lines aimed to reduce the menace of the Red Army; Eliminate the menace of the vicious propaganda of its present rulers;

Obtain recognition of the rights of the Russian people to have a free press, a free expression of opinion, free elections of government officers and definite property rights;

A quick settlement of the German reparations with terms of payment compatible with existing conditions even though they recognize, as they should do, that Germany should pay a real penalty.

A cancellation after agreements as to co-operation of some percentage of the Inter-Allied loans that can fairly be estimated to represent a direct and legitimate war charge to the nations taking part in the cancellation;

Reduction of governmental waste;

Stoppage of inflation caused by the issuance of new currency and increase in floating loans;

The removal of trade barriers by means of special commercial treaties and agreements between nations;

Greater co-operation between capital and labor so as to allow for the increase of production as rapidly as concurrent developing conditions enable its absorption; a better world morale working toward the elimination of class and national hatreds and the increase of integrity and square dealing.

Financing Exports

The group session dealing with the problems of the exporter included addresses on "Financing Export Shipments," by W. H. Knox; "Co-operation of Export Merchant and Manufacturer," by C. W. Beaver, and a paper of similar nature by G. R. Parker. Export advertising aimed to reduce the cost of export selling was discussed in "Practical Use of Available Information," by Wm. Menkel; "Organization and Management of Advertising Forces," by Jas. S. Martin; and "Co-operating with Dealers," by D. L. Brown.

Another group on foreign credits and credit information had three interesting papers: "The Three C's in Foreign Credit Guaranty," by A. T. Richards; "Practical Safeguarding of Foreign Credits at Minimum Cost," by M. H. Hopkins; and "Guide Posts in Foreign Credit Guaranty," by L. R. Browne, who said:

"One whose province it is to administer foreign credits should bring vision and understanding to its problems, striving to look into the future, not permitting himself to be bound by a too narrowly restricted consideration of the one problem before.

"The aim of the credit manager should be: To build a foundation for future business that will endure. He should be actuated by larger motives than the desire to invariably and above all things play safe no matter what may fall.

"Granted the vision and understanding which success in his field of endeavor demands he will perhaps at times assume risks which, if measured solely by a rigid application of any set of hard and fast credit rules, would seem to carry more than ordinary business hazards but with supreme faith in the people with whom he deals, in the fundamental soundness of their country and the worthiness of their motives—all these, the offspring of knowledge—he will take his risk confidently, sure, even in the face of a conviction that conditions may require the granting of extensions or that drafts may not be paid exactly on maturity dates that time and results will bring justification. He will build good-will and confidence and inculcate in the minds of his foreign customers that priceless asset—an unshakable confidence born only of the highest type of intelligent, dependable and sympathetic service."

Importance of Credit Supervision

Mr. Browne then went on to describe in detail the ideal credit manager whom he pictured as one knowing as much about other countries, the lives and habits of other people as he should concerning those of the country in which he lives and whose language he speaks.

"There is a fairly general and mistaken impression that credit information is limited to such facts as may be found only in a financial statement, analyzed according to fixed rules, coupled with a summary of expressed opinions as to character and capacity," said Mr. Browne.

"In its broader aspects, credit information goes far beyond any such narrow limits, especially to one whose responsibility it is to determine the measure of the risks involved in foreign transactions. There are few known or ascertainable facts bearing on the lives of the people of countries with which he deals, whether of a political, traditional, historical, phychological, social, economical, physical, geographical, climatic, commercial or of even a religious character that should be lacking in interest to the foreign credit grantor or be considered of no value to him or by him. The greater store of such knowledge he possesses or is in position to command, coupled with ability to apply it with judgment, the more efficient he becomes."

A banquet, at which Gov. Sproul of Pennsylvania spoke on "Foreign Trade and Domestic Prosperity," closed the convention.

Manufacturers See Prosperity Ahead

Twenty-four Hour Report from Industrial Centers Shows Great Improvement—Favor Greater Navy and Merchant Marine—Edgerton Re-elected

A decidedly optimistic outlook for American business and a greater faith in the future of our industrial life, was the keynote of the twenty-seventh annual convention of the National Association of Manufacturers, held in the Waldorf-Astoria Hotel, New York City, on May 8, 9 and 10. The convention was attended by over five hundred of the most prominent manufacturers in the United States. Practically all lines of business were represented and the general spirit of the meeting was one of revived optimism and an awakening of business men to a greater responsibility of their relation to the needs of the industry.

The outstanding feature of the three-day meeting was the twenty-four hour report on business conditions which was presented at the afternoon session on Tuesday. This report gave a first-hand résumé of business conditions as they were during the first twenty-four hours during which the convention was in progress. In announcing the result of the survey, President Edgerton said that business was shown to be on the upgrade in practically all the basic industries and that "we have not only turned the corner, but are now leaving it very far behind." The survey was compiled within twenty-four hours of its presentation and was based on more than 30,000 answers from a questionnaire sent to all members of the association, and represented an immediate summation of conditions in every section of the country.

Among key industries the survey showed conditions in the iron and steel trade classed as excellent in 6 per cent of the plants reporting; 25 per cent were stated as good; 52 per cent as fair and 17 per cent as poor. For the fall this industry reported prospects of excellent business in 4 per cent of the replies; good in 50 per cent of the replies; fair in 43 per cent of the replies and poor in only 3 per cent. Compared with last year, 75 per cent of these factories and mills reported conditions better than last year; 15 per cent report conditions lower and 10 per cent of the cases report no change. Stocks were reported normal by these industries in 60 per cent of the cases, low on 33 per cent and over in only 7 per cent. As to employment, a large increase was reported in 23 per cent of the cases; a small increase in 47 per cent of the cases; a large decrease in only 6 per cent and a slight decrease in 23 per cent. For the fall the outlook is for a large increase in 32 per cent of the factories, a small increase in 68 per cent, and not a single one reported no increase.

Eighty Per Cent Normal

In the machinery and tool industry, 80 per cent of the replies reported present conditions from fair to excellent and the remainder reported less encouragingly. Ninety per cent look for fine business in the fall. In 70 per cent of the replies, business is reported better than last spring; 16 per cent seeing no appreciable change, and 14 per cent finding a decreased business. They have increased their factories' forces, but for the fall 90 per cent look for a decided increase in the working forces and less than 1 per cent look pessimistically for a large decrease in employment.

In his annual address to the association, President John E. Edgerton urged the members to lend their influence and effort to the combating of syndicalism and socialism, "and other mental and moral diseases with deceiving names" which are invading our schools, churches and legislative bodies. He concluded with an expression of his belief that the country would soon be on a normal production basis.

More Production Needed

He said: "The chief of all the economic problems of this hour is a world production sufficient for a world's needs, and a simplified system of distribution that will reach to every human being. The proportion of consumers to producers is too large, and the energies and talents of too many people are engaged in the process of distribution. When you add to the superflous number of the distributors of the products of the producers the countless host of those whose chief activities are to reform, regulate, inspect, denounce, tax, plunder and otherwise live upon those who are trying to produce something, it will not be difficult to discover the principal factor in the continuing high cost of living.

"But we have in America all of the materials and brains necessary to the restoration of a wholesome condition throughout the country, and a large amount to spare to other more unfortunate peoples. And in spite of the innumerable obstacles ahead of us at the beginning of our march toward stable conditions, and of the many yet unsurmounted, I am one of those who believe that we have made all of the progress that we could have reasonably expected to make in so short a time after the world cataclysm, and that we shall continue with probably occasional halts to the heights of a national and world greatness not hitherto known."

The Monday evening session was devoted to a discussion of foreign trade, its present status and its future possibilities. Edward C. Plummer, commissioner, United States Shipping Board, spoke on the relation of the merchant marine to our foreign trade. He said that it was a recognized truth that only through its own ships can a country properly develop its foreign trade and that it was evident that only through such a merchant marine as we propose that the foreign trade of this country could be properly developed, and the industries of this country be given their proper opportunities. Shipping is a means and not an end.

In pleading for a nationwide support of a greater merchant marine he said in part: "One very common plan apparently adopted for the purpose of misleading the public appears in the statement so often made that the United States aims to become commercially supreme upon the seas. No intelligent American aims at that. What thoughtful Americans desire is that the United States shall have a merchant fleet sufficient to enable this country to handle a similar proportion of its foreign commerce, and the proportion which England has insisted on carrying of her own foreign commerce, viz., from 60 per cent to 75 per cent is good enough for us—but we should insist upon carrying as much in the interest of the people of this country.

"To claim anything else is merely to say in effect that we don't want American ships to carry any material part of the commerce of this country—that we don't want to enlarge the markets for American products or give increased employment to American labor."

F. C. Schwedtman, vice-president of the National City Bank, New York, spoke on the financial side of the foreign trade question. He devoted the greater part of his address to an analysis of foreign loans and the position of American banks in the upbuilding of foreign trade. The stabilization of the principal currencies of the world, he declared, was a pre-requisite to the prosperity of world trade, and he explained the extent of and the limitations on aids to exporters by American banks.

He said: "World trade can never prosper until the principal currencies of the world are stabilized. The credit structure must be built on factors that are reasonably certain. The world's desire for a fixed gold standard by which goods may be valued and business carried on is shown by the widespread desire in every country for dollars."

While he gave an emphatic affirmative to the question whether foreign bond issues sold here were beneficial to our foreign trade, he was equally emphatic in declaring against restricting the spending of the proceeds of these flotations to American merchants and manufacturers.

Governmental Regulation

The afternoon of Tuesday was given to a business revival session. The main speaker was Senator Walter E. Edge, of New Jersey, whose subject was "The Duty of Government to Business." The Senator gave a brief summary of his resolution, recently introduced in Congress, providing for governmental regulation of trade association activities. He said:

"I recognize that business doesn't like governmental regulation and I sympathize with business in that viewpoint, but my friends you must take one thing or the other: You must either take, under present conditions, continued investigations and efforts of grand juries, to indict business representatives (because they in many cases innocently trespass upon the present acts regulating business and that is happening today as you well know): or you must accept the official co-operation of some governmental body which has delegated power to talk to your representatives and to discuss the limit to which you can go, in their judgment, in the way of publishing information, statistics and all the other activities that trade associations indulge in."

Other speakers at this session were: J. R. Howard, of the American Farm Bureau, on "The Farmer and Industry"; R. C. Marshall, Jr., Associated General Contractors of America, on "The Greatest Revival in the Construction Industry"; J. D. A. Morrow, National Coal Association, "The Outlook for Coal"; W. Averell Harriman, United American Lines, on "The Future of Our Shipping Industry"; C. M. Ripley, General Electric Co., on "Interpreting the Corporation to the Worker."

On Tuesday afternoon the officers and directors of the association were invited to the Brooklyn Navy Yard by Admiral R. E. Coontz, chief of Naval operations, U. S. N. The party was entertained on the battleship "Wyoming," flagship of the Atlantic Fleet. Rear Admiral John D. McDonald, commander of the fleet, welcomed the guests on board, and in a brief after-dinner speech asked them to give some thought to the proposed cut in the Navy personnel. He said that ships do not fight ships, but that men fight ships. The guests were conducted on an inspection of the vessel by the staff officers of the Admiral.

At the annual banquet held in the grand ballroom on Tuesday evening James A. Emery, general counsel for the association, was toastmaster. The speaker of the evening was Admiral R. E. Coontz, U. S. N., who made a stirring appeal for a greater and better navy. He dwelt at some length on the value of the Navy as a factor in foreign trade, detailing its work in the past in opening foreign ports and keeping the seas open to American traders. He said that $300,000,000 a year was not much to spend on a Navy that aided so materially in maintaining an annual foreign trade of over eight billion dollars.

He said, "If we spend $300,000,000 a year on the Navy, and thereby maintain an open market throughout the world for $8,000,000,000 worth of exports, is this not a good investment? Money spent on the Navy serves the dual purpose of insurance in time of peace and a fighting force in time of war. We should have a Navy of sufficient strength to support our policies and our commerce, and to guard our continental and overseas possessions. Our foreign policies are as strong as our fleet and no stronger.

Fallacy of Disarmament

On the subject of disarmament he had this to say: "It is a popular fallacy to think that a holiday in battleship building will bring a great reduction of taxes. A slight study of history is sufficient to show that disarmament will not prevent war. Many of the pacifists seem to think that military forces are only bent on destruction. As a matter of fact they are really constructive. Wherever they go, they better local conditions, establish schools and improve public health. Panama at one time before we went there was a fever infested place where human beings died like flies. It can truly be said that our armed forces have saved more lives than they have taken."

The subject of trade associations which has occupied the minds of public officials and business men of late was thoroughly discussed at the Wednesday morning session. Secretary of Commerce Herbert Hoover was chairman of this session and delivered the opening address. Mr. Hoover gave an intelligent analysis of this question. He praised the work of legitimate trade associations and said that their assistance has been invaluable to the Department of Commerce in its reorganizing work.

Referring to the recent governmental investigation of the purpose of certain questionable practices in trade associations, he said:

"It is my belief that if trade associations are to grow in beneficent directions they should have some definition in law that will remove the uncertainties of their situation.

"The proposal that I should like to put forward for your consideration is a simplification of the proposals recently made by Senator Edge. I claim

JOHN E. EDGERTON

no originality in them, for similar suggestions have long been under discussion. Without entering upon legal formulation, my suggestion is that there should be enacted a minor extension to the Clayton Act to the effect that interstate trade associations should be permitted to file with some appropriate governmental agency the plan of their operations and the functions they propose to carry on. That upon approval of such of these functions as do not apparently contravene the restraint of trade acts, they may proceed with their operations. If, upon complaint, however, either of individuals or the law officers of the Government, that these functions do restrain trade, then after a hearing and proof the right to continue these particular functions shall be suspended, and if continued they shall be subject to prosecution. Also, if it shall be proved that they have extended their activities beyond the functions in their original proposals they shall be subject to prosecution from restraint of trade violations. Associations which do not wish to secure this limited interpretation of the law with its assistance to confidence should not be required to do so; they, however, necessarily assume themselves the job of interpreting the law with the risks such interpretation entails. All who know the situation in these associations will realize that in the main their membership comprises a smaller business. Such measures will serve to protect small business, for big business takes care of itself.

"I need not refer here to the beneficent results that have been attained to the community by the legitimate associations in the safeguarding of quality of goods, in reduction of waste in manufacture and distribution, in promotion of foreign trade, and a score of directions that make for the upbuilding of our commerce and industry. These are the sort of things that we must preserve in American life."

Other speakers at this session were: Alfred L. Reeves, president, Trade Association Executives of New York; Morris L. Ernst, counsel, Jewelers Board of Trade, New York; H. B. Thompson, counsel, Proprietary Association, Washington; C. R. Stevenson, of the Stevenson Corporation.

On Wednesday afternoon the convention was addressed by the Secretary of Labor, James J. Davis, who devoted his remarks to an explanation of the work of his department in its relation with the employer and the working man. He asked for the co-operation of the manufacturers in making the Department of Labor a greater force in curing industrial ills. He declared that unemployment was a piece of "needless stupidity," and wound up with a plea to employers to give every opportunity to the younger generation to learn a trade, which he declared was the foundation of a good education and a good business training.

Against the Bonus

Several important resolutions were presented and adopted at this session. One called upon Congress to maintain a Navy of the United States at a ratio in keeping with the national dignity and of sufficient strength to assure adequate defense. Another resolution condemned a cash bonus for World War veterans, but commended the work of the U. S. Veterans' Bureau in its work of rehabilitation and vocational training. The convention also approved by resolution the proposal of President Harding in asking Congress to support an adequate American Merchant Marine. Still another resolution asked for substantive changes in the present tax laws, so as to provide a better recognition of business enterprise by assuring a greater return on capital invested. The association went on record as opposed to the Stanley patent bill (S-3410), "because it introduced in our patent system an obligation on American patentees to work their inventions within a limited period and subjects them to the grant of compulsory licenses, both of which provisions are an unwise innovation in the American patent system . . . this will discourage invention and impair the value of American patents and will impede, instead of promote, the progress of the useful arts in this country."

The election of officers resulted in the unanimous selection of John E. Edgerton, of the Lebannon Woolen Mills, Nashville, Tenn., to serve another term as president. Vice-presidents were chosen from each of the states represented. George S. Boudinot, of New York was elected secretary and Henry Abbot, treasurer.

The closing number on the program was a motion picture showing of industrial films. As the pictures were thrown on the screen, they were explained by men from the field of industry which they illustrated. Mining, farming, electrical phenomena, railroad operations, and radium production were some of the subjects covered.

Supply and Machinery Men Hold Conventions

Manufacturers and Dealers Talk Over Business Problems—Legislation to Unfetter Business Urged by Manufacturers—Spirit of Sane Optimism Shown

Very interesting and profitable conventions were held on May 8 to 10 at the Marlborough-Blenheim Hotel, Atlantic City, N. J., by the American Supply and Machinery Manufacturers' Association and the National Supply and Machinery Dealers' Association.

Business conditions were fully discussed and ideas as to the future exchanged. The needs of an intelligent interest in world problems and of the application of sound economic principles to business were quite generally expressed. The keynote of the manufacturers' meeting was the liberation of business from the legislation that now hampers its activities. The dealers were interested primarily in ways and means to reduce overhead expense, so as to enable them to do business under present conditions.

The American Supply and Machinery Manufacturers' Association began on Monday morning with an executive session that was largely a continuation of the meeting held at Birmingham on April 24 to 26. President N. A. Gladding, of E. C. Atkins & Co., Inc., Indianapolis, in his opening address laid stress on the importance to the business man of keeping well posted on developments of importance to the community and to business in general. After citing cases such as the proposed Edge law and the bonus bill now before Congress, he stated that business men must make themselves felt in Washington in order to affect the legislation on problems in which they are so vitally concerned.

Capt. John W. Gorby, of the Cyclone Fence Co., Waukegan, Ill., told in a very interesting way how some concerns have solved the post-war business problems. He said that the best means at the disposal of the business man for meeting the present conditions are the use of advertising, better salesmanship, and the more rapid turnover of goods. Captain Gorby believed that our problems would all eventually be solved through the great and varied resources of America and her people. His closing remarks dealt with the need of faith in the future, centering about the words, "As your faith is, so be your prosperity."

The need of applying sound economic principles to business was brought out by A. T. Simonds, of the Simonds Manufacturing Co., Fitchburg, Mass. He said that we needed the ability to better predict the future of business, in order to cut out the valleys and the peaks of the business curve. To do this a man must have a broad knowledge of the factors entering into the problem, and he cannot limit his knowledge to one line of work. Mr. Simonds said that he thought business in general too much hampered by legislation, and pointed out the advisability of putting business men in position to make our laws. He predicted that the wave of activity now beginning would be short, being broken by a depression and followed by a long period of falling prices.

In the afternoon the session was held jointly with the National Supply and Machinery Dealers' Association. President Gladding opened the program, treating chiefly with business as related to affairs at Washington. He decried class legislation, but advised close contact with the law-making machinery of the country. He asked that support be given to Secretary Hoover and to others who are doing constructive work for business in general.

An excellent address was delivered by Rev. James E. Crowther, D.D., of Philadelphia, on "Theodore Roosevelt—American." In telling of the qualities and the varied activities of our late president, Dr. Crowther showed that

IRVING W. LEMAUX
President of Manufacturers

Roosevelt was the very embodiment of the idea of Americanism.

The necessity of "seeing things as they are" was brought out by G. A. O'Reilly, vice-president of the Irving National Bank of New York. He applied this necessity particularly to conditions abroad and to our relations with other countries. It is useless to attempt to hurry developments, such as the financing of export trade, until the country at large realizes the importance of such steps and is ready to take them. For this reason general education on the value of foreign trade is necessary before any attempt is made to create a mechanism for carrying on such trade. Mr. O'Reilly said that he believed we would never "go back to normal," because we are constantly progressing. Our problems, however, will work themselves out just as they have been doing.

The dealers' and jobbers' problems and viewpoint, with particular reference to the South, were presented on Tuesday afternoon by Alvin Smith, of the Smith-Courtney Co., Richmond, Va., and secretary of the Southern Supply and Machinery Dealers' Association. He treated such subjects as discounts, wholesale prices and the cost of doing business. Mr. Smith urged manufacturers to maintain definite sales policies, so that dealers are afforded greater protection. He spoke of the value of the dealer to the manufacturer and asked for better acquaintance and closer co-operation between them for their mutual advantage.

The keynote of the whole convention was struck by the Honorable Felix H. Levy, of New York, who addressed the association on the subject of "Anti-Trust Laws." He stated that business men were too greatly hampered by legislation, which interferes with the very details of their daily business. The Sherman Law has fallen from its original purpose of breaking the big trusts, and is now restricting business in a way that is detrimental to its growth. Mr. Levy believes that the recent decision in the Mennen case is a mis-interpretation of the Clayton Law. He believes that historians will consider as very unique our laws governing business, as they are opposed to those existing in all other countries. Business men are prevented from employing through their trade associations the greatest means that could be used for stabilizing business, that of agreeing on terms of sale and prices. The efforts of Senator Edge and of Secretary Hoover deserve commendation, Mr. Levy said, although the passage of laws to unfetter business must mean also a revision of the Sherman Law.

The last session, held Wednesday morning, was primarily executive. A resolution was adopted supporting Senator Edge of New Jersey in his attempt to relieve the hampering of trade associations by the existing anti-trust laws. The resolution "earnestly recommends to Congress enactment of suitable legislation which will remove the hindrances and obstacles placed by the anti-trust laws upon trade associations, whereby co-operation by them in many important fields of activity is prevented."

Cincinnati was chosen as the place of the next convention.

The officers elected for the coming year are: President, Irving W. Lemaux, Indianapolis Brush and Broom Manufacturing Co., Indianapolis, Ind.; first vice-president, Dave C. Jones, Lunkenheimer Co., Cincinnati, Ohio; second vice-president, C. W. Machon, Brown & Sharpe Manufacturing Co., Providence, R. I.; third vice-president, M. B. Skinner, M. B. Skinner Co., Chicago, Ill.; executive committee, A. T. Simonds, Simonds Manufacturing Co., Fitchburg, Mass.; Joseph M. Hottel, Delta File Works, Philadelphia, Pa.; John C. Ruf, T. B. Williams & Sons, Dover, N. H.; W. H. Glatt, Victor Balata and Textile Belting Co.. New York, N. Y.; W. H. Fisher, T. B. Wood's Sons Co., Chambersburg, Pa. F. D. Mitchell, New York, N. Y., continues as secretary-treasurer.

The attendance at the convention was quite large, and great interest was shown in the program. In the evenings entertainment was provided for members and their guests, a dance being held on Monday and a concert on Tuesday.

National Supply and Machinery Dealers' Association in Seventeenth Annual Convention—Reduction of Overhead Expense the Greatest Problem of the Dealer

The National Supply and Machinery Dealers' Association devoted its opening session largely to discussing the business situation with relation to machinery and supplies. President Crannell Morgan, of the Hardware & Supply Co., Akron, dealt in his address with the problems that now face the machinery dealer. He spoke of the activities of the dealer during the war and the period immediately following it. Although expenses incurred in selling were very high during that period, the margin on which business was conducted was held practically constant because of the large volume of the business. Now, however, the volume is so small that reduction of the overhead expense is necessary in order to make business again profitable. More rapid turnover and conditions of trading with the manufacturers that are at least as favorable as must be extended to the customers, are the chief means of making trading safe in the near future.

The report of the secretary, Thomas A. Fernley, gave a résumé of the year's work and the prospects for the future. The attitude of the government toward the work of trade associations was given attention, as well as Federal tax problems. The price position in the industry and the matter of overhead expense received particular mention.

A discussion and interchange of information that brought out many interesting facts regarding business conditions then followed. Most of the members have now greatly reduced their stocks of merchandise, and have consequently reduced overhead expense. A faster turnover seems necessary in order to survive the existing conditions. Although most of the dealers aim to handle, in the main, goods on which the investment can be turned over four times a year, few of them have been able to obtain this rate.

The members as a group stated that business had improved somewhat, and they believed that it would continue to do so for some time. However, because of the condition of the market and the smallness of margins, averaging only 10 per cent on most lines, inventories and overhead must be watched with the greatest care for several years to come. Although it was believed that a reinstatement by the manufacturers of pre-war selling terms and conditions was desirable for stability, it is not now possible of attainment.

On Monday afternoon a session was held jointly with the American Supply and Machinery Manufacturers' Association, as just related.

The session on Tuesday morning was devoted to talks by manufacturers giving information regarding such business conditions as supply and demand, raw material, labor, present consumption and the prospects for consumption and prices in the future. J. H. Williams, president of J. H. Williams & Co., Brooklyn, spoke of conditions in the drop-forging industry. Mr. Williams urged co-operation between dealers and manufacturers in order that a firm basis for transactions could be developed. He stated that the drop-forging industry was at present greatly disorganized. He expected that the deflation that remains to be done would occur gradually and that further revival would be necessary before additional liquidation would occur. He expressed the belief that the next tendency in prices in his line would be upward.

Conditions in the twist-drill industry were described by Robert S. Carter, sales manager of the Whitman & Barnes Manufacturing Co., of Akron. It was shown by the speaker that present prices of twist drills are below the cost of manufacturing and selling them, and that the next price movement must logically be upward in order that the industry may survive. The volume of sales at the present time is increasing. Mr. Carter advocated a bigger margin on which to do business, as well as very liquid stocks for the jobber. He spoke favorably of the European plan of selling goods, in which the buyer pays directly for each extra service that is given him, instead of caring for all service costs in the original price.

W. J. RADCLIFFE,
President of Dealers

Irving W. Lemaux, president of the Indianapolis Brush and Broom Manufacturing Co., Indianapolis, stated that since manufacturing costs are rising, it was logical to expect an increase in selling price. Business is increasing in volume at the present time, so that Mr. Lemaux was optimistic as to the future.

A general survey of business was given by Wallace L. Pond, domestic sales manager of the Nicholson File Co., Providence. Mr. Pond pointed to the large sums now being released by the railroads for supplies, to the better conditions prevailing in the agricultural regions, and to the improvement in business conditions and employment quite generally. The advantages of simplification of stocks were brought out by an example taken from his own concern.

W. W. Sanderson, general sales manager of the Carborundum Co., Niagara Falls, said that conditions in the abrasive industry seemed somewhat better in 1922 than they were in 1919. Since there is too much of a gap between manufacturing and sales organizations, Mr. Sanderson urged greater co-operation. He recommended that business conditions and prospects be carefully analyzed, in order to arrive at a safe basis for continuing operations.

The session was closed by A. T. Simonds of the Simonds Manufacturing Co., Fitchburg, Mass., who told of the value of applying sound economic principles to the conduct of business.

On Tuesday afternoon the subject of the readjustment of overhead expense to meet changed conditions incident to lower prices and slow business was discussed by the members at large. It developed that one of the principal means of modifying the current difficulties lay in the simplification of the variety of goods manufactured. It was recommended that information be exchanged locally in credit matters, so as to mutually protect the dealers. The giving of cash premiums also received attention.

The association desired to call to the attention of government bodies such as the Federal Trade Commission, the right of the supply trade to be recognized in its service of distributing goods. It adopted a resolution to ask for a setting aside or a modification of the order given recently in the Mennen case. The sentiment was that the manufacturer should be free to set selling prices for his dealers, provided that he does not enjoy a monopoly in his field.

In the closing session on Wednesday morning the dealers talked chiefly on the compensation and the handling of salesmen. It developed that, in general, city salesmen do not receive credit for sales to their customers unless they actually take the orders, although country salesmen receive credit for all sales made in their territory even if they do not actually write the orders themselves.

The following officers were elected for the ensuing year: President, W. J. Radcliffe, of E. A. Kinsey Co., Cincinnati; first vice-president, L. H. Swind, Swind Machinery Co., Philadelphia; second vice-president, B. H. Ackles, of the T. B. Rayl Co., Detroit; executive committee, F. Alexander Chandler, of Chandler & Farquhar Co., Boston; H. C. Ellsworth, of the White Tool and Supply Co., Cleveland; and George F. Root of Root, Neal & Co., Buffalo. Thomas A. Fernley of Philadelphia continues as secretary-treasurer and T. James Fernley as advisory secretary-treasurer.

Post Office Gets $376,500 for Canceling Machines

The House and Senate conferees on the postoffice appropriation bill for the next fiscal year have agreed on $376,500 for canceling machines for the postal service, instead of $350,000 as originally provided by the House. Of this amount it is specified that $26,500 shall be used for the purchase and installation of a letter distributing machine, if on test such a machine is found to be satisfactory and efficient. The conferees eliminated the provision that postal funds shall not be expended for the purchase or repair of any commodity which can be manufactured or repaired at the nearest available government arsenal or navy yard for less.

The Business Barometer

This Week's Outlook in Commerce, Finance, Agriculture and Industry Based on Current Developments

BY THEODORE H. PRICE
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All the markets moved logically last week. Commodities, which are just commencing to reflect the general recovery of confidence, were firm with an upward tendency, but stocks and bonds, some of which were from 30 to 50 per cent over the lowest prices reached, were reactionary.

This was entirely natural. The strongest man grows weary and must rest. No market can advance uninterruptedly and a period of quiescence for the digestion of the enormous bond issues recently placed was long overdue. It appears to have arrived last week and the $75,000,000 Federal Land Bank 20-year bonds which were sold on a 4½ per cent basis in a day seem to have been the *bonne bouche* that created a consciousness of satiety. Subsequent offerings were smaller and were not so well taken and it is said that other issues planned for the near future have been put in cold storage for a while. Concurrently and consequently there was some liquidation of speculatively held stocks which was perhaps accelerated by failure of two relatively unimportant brokerage houses. But in so far as the security markets are concerned the halt was perfectly normal and is not to be construed as indicating any change in fundamental conditions. The course of prices on the Stock Exchange generally foreshadows a commercial revival or contraction.

Revival to Last

The revival in general business that is just beginning has been indicated in the stock market for the last three months. Even if it were destined to be short lived it would continue through the summer and there are many reasons why it should last much longer. Of these the most important is that the nation's shelves are bare and many of its people inadequately housed.

The ease of money has started a movement to correct these conditions that cannot possibly be completed within a year and for that time at least activity will continue and labor will be employed. The stock market will meanwhile go up and down, but no disastrous break is probable until bank reserves and the money market signalize a prospective shortage of credit and even then it is likely that the signals will be for a time ignored.

As justifying this prognosis, there is to be noted continued strength in cotton and cotton goods, wool and woolen goods, wheat and corn, iron, steel and copper, burlaps and jute, silk, linen and flax, hides and leather, and several other less important staples. Coffee is lower because the bearish significance of the Brazilian coffee loan is commencing to be understood, but sugar and rubber, though stationary, are daily getting into a stronger position.

As was the case last week the firmness in each instance is attributed to some technical trade influence or development, but the movement is too inclusive to be adequately explained by technicalities. The broader basis upon which it rests is the abundance of credit that first made it possible to sell billions of bonds and is now reflected in the expenditure of the money received for these bonds for the construction, equipment and goods of which society was in need and in the fabrication of which labor is employed.

A Boom Coming

The cycle that embraces these sequences extends far beyond that within which the stock market moves and as it is altogether unlikely that it will be completed within the year I see no reason to doubt that the business activity due about July 1 will continue through next winter. It is, indeed, quite possible that we may have a secondary boom in the stock market as the money spent gets into circulation and passes back into the banks through the channels of trade.

The possibility of such a boom is perhaps increased by the gain of $10,500,000 in gold shown in the weekly statement of the Federal Reserve System. As a result the reserve ratio is slightly higher at 77.3 per cent against 76.7 at the end of the previous week. This renewed influx of gold is a distinct surprise and if it continues, which seems hardly possible, the advance in interest rates that some expect is likely to be deferred. The merger of Mr. Schwab's Bethlehem Steel Corporation with the Lackawanna Steel Company, involving as it does properties capitalized for nearly $400,000,000, is another incident that may excite the speculative imagination.

For the present the financial world seems a little less disposed to ignore the muddle at Genoa and the various other clouds to which I have previously called attention. Their passing may therefore end the hesitancy that now prevails among the mercurial speculators in the security markets.

For we must never forget that even the blackest clouds are dissipated in time and it is in order to observe that the textile strike seems nearer an end than for some weeks and that an advance of $1 a ton in the price of bituminous coal has already reinvigorated the previously languid effort that the Government was making to settle the coal strike. There is also some reason to hope that President Harding's fabian policy of opposition to the bonus bill may defeat it, though this is doubtful. As to Genoa all that can be said is that the inconclusiveness of the conference leaves things about where they were and that some good and no harm has been done by the exchange of views.

The relative strength of sterling as compared with francs and marks would indicate that the shrewd judges of international credit who dominate the market for foreign exchange do not consider that Great Britain's financial position has been impaired by the imbroglio at Genoa, and in the United States despite the "ancient grudge" there is a feeling that Europe will somehow muddle through if the British Empire stands.

In Germany the complete demonetization of the mark seems only a question of a short time unless she can get a large foreign loan, for according to the statement of May 6 the paper currency outstanding amounted to 141,000,000,000 marks. This is an increase of 10,000,000,000 marks in the last fortnight.

No review of the week would be complete that did not include an allusion to the dinner to which President Harding has invited the chief railway executives of the country. It is reported and believed that he intends to urge an immediate and substantial reduction in freight and passenger rates. If this be true and his recommendation is accepted the effect upon business will probably be electrical, for modern commerce is directly dependent upon transportation and its cost. It is in fact doubtful whether either the business men or the railway officers realize what an increase in both the volume of goods handled and the carriers' net and gross revenue would follow a substantial reduction in rates.

Would Stimulate Business

The earnings of the roads are largely dependent upon the density of traffic and the consumptive power of the country is mainly a question of the cost at which its products can be distributed to its markets.

A reduction in railway rates sufficient to be really appreciable would give a stimulus to business that would be nation wide and it is to be hoped that the President will continue to use the influence of his great office to secure it.

In some cases the present tariff penalizes the enterprise of those pioneers who are trying to develop the remoter sections of the country, by freight charges that exceed the value of the article carried.

The result has been bankruptcy for some of those who are distant from the consuming centers where there is congestion, unemployment and unrest because the cost of transportation is a centripetal influence that prevents the distribution of the population.

Navy Wants Brass

The Navy Department has called for bids covering the following: Naval rolled brass bar, 36,618 lb.; commercial brass bar, 4,976 lb.; cast brass billets, 50 lb.; brass welding rods, 146 lb.; bronze rivet rod, 13,405 lb.; bronze phosphor bar, 20 lb.; bronze manganese bar, 6,062 lb.; copper bar, 1,776 lb.; copper, phosphor ingot, 485 lb.; muntz-metal bar, 3,749 lb.

The Trend of Business Improvement—Plants Resuming

The Commercial Steel Casting Co., Marion, Ohio, manufacturer of open-hearth steel castings, is operating at maximum capacity under the greatest volume of business ever experienced. Work has been commenced on an addition to double the present capacity.

The Motor Products Corporation, Ann Arbor, Mich., has adopted a night schedule of operation at its plant, in addition to regular day work.

The Delaware & Hudson Railroad Co. has resumed operations at its shops at Carbondale, Pa., following a shut down for several weeks.

The Maxwell Motor Co., Detroit, Mich., has added about 1,000 men to its working force during the past fortnight, bringing operations at the plant up to full capacity on an increased working basis of 300 cars a day.

The Perry-Fay Co., Elyria, Ohio, manufacturer of capscrews, bolts, etc., has adopted a full time operating schedule at its plant, giving employment to the regular working force.

The Reading Iron Co., Reading, Pa., has resumed operations at its plant at Birdsboro, Pa., devoted to the production of nails, etc. The mill has been closed down for about twenty-four months.

The Michigan Screw Co., Lansing, Mich., is advancing production at its plant and adding a large number of men to the working force. About 100 automatic screw machines, idle for more than fifteen months, have been placed in service.

The Gardner Motor Co., St. Louis, Mo., has increased production to a basis of 1,500 cars during May, as compared with an output of 1,050 automobiles during April. Additions are being made to the working force.

The Hoover Steel Ball Co., Ann Arbor, Mich., is increasing operations at its plant and about fifty men have recently been added to the working force.

The Dort Motor Car Co., Flint, Mich., has increased production to a basis of 100 cars per day, as compared with an output of 40 cars daily in March. Large additions have been made in the working force and all departments are running full.

The Western Automatic Machine Screw Co., Elyria, Ohio, has adopted a full time operating basis at its plant, giving employment to the regular working quota.

The Railway Steel Spring Co., New York, is increasing production at its plants at Depew and Hudson, N. Y., and at other points. A night shift has been inaugurated in a number of departments and additions made to the working force.

The Slatington Iron and Steel Co., Slatington, Pa., has reopened all departments at its plant, some of which have been closed for more than two years.

The Fox Furnace Co., Elyria, Ohio, has adopted a capacity schedule at its plant, with orders on hand to insure this basis for some time to come.

Dodge Brothers, Detroit, Mich., have increased the working force to about 13,000 men, with all departments running full time, on an average basis in excess of 600 automobiles a day.

The Production Foundries Co., Ann Arbor, Mich., has increased operations to a 100 per cent basis, with full time, full working force employment in all departments.

The Atchison, Topeka & Santa Fe Railway Co., has advanced operations to a full time, six-day week basis at its car shops at Cleburne, Tex., following a five-day week schedule for some time past. Production has also been resumed at the locomotive shops of the local plant.

Jones, MacNeal & Camp have started operations in the new factory at Warsaw, Ind. The company moved from Chicago about a month ago and has been busy setting up machinery and arranging equipment for several weeks. The plant will manufacture electric drills. It is expected that the working force will be gradually enlarged.

Chicago Letter

In general, business conditions in the Western machine tool industry continue to show an improvement and the outlook is very optimistic. Inquiries continue to out-number the amount of orders booked. The recent activities on the part of the automotive industries in buying machine tools, and a report which comes from a reliable source that the Santa Fe Railroad will place a number of orders by June 1, are two of the facts which help make the outlook optimistic at the present time.

Although most plants have not even given a thought to the present coal strike a few of them have stated that they will not be able to continue to sell at the present prices if they are forced to get their coal from the East.

The Chicago, Indianapolis & Louisville is inquiring for a 5-ft. radial drill. The Chicago, Milwaukee & St. Paul is inquiring for a 44-in. vertical boring mill, and a 36-in. lathe. To date the Illinois Central has not made a single inquiry for machine tools, but at the present time is asking for bids on five passenger cars 72-ft. long and has placed an order for 110 tons of bridge steel with the Truscon Steel Co., for use in a bridge at Homewood, Ill. There is also a report that the C. I. & L. has ordered 3,000 tons of rails from the Illinois Steel Company.

The Board of Education of Chicago recently awarded a contract to A. & E. Anderson, 19 South La Salle St., for the construction of a $3,000,000 addition to the Crane High School.

The Bates Valve Co. recently purchased eight hundred feet frontage on 83d St., South Chicago, Ill. They are contemplating the erection of a factory and will consolidate their four plants now located at various points.

The Strongheart Company, 1516 South Wabash Ave. recently purchased from the Stringer Brothers Foundry Co. the two-story factory building at 2944 West Lake St., which will be used for their business.

The Mt. Vernon Car Manufacturing Co., Mt. Vernon, Ill., has awarded a contract to the Hughes-Foulkrod Co., Pittsburgh, Pa., for the construction of a one-story foundry for the production of iron and other metal castings; it is estimated to cost about $250,000 including equipment.

Heald Machine Co. Salesmen Hold Conference in Worcester Plant

A three-day conference of salesmen was held at the office and plant of the Heald Machine Co., Worcester, Mass., May 8, 9 and 10, which was attended by the company's salesmen from all parts of the country. The objects of the conference were to promote a mutual understanding between the men and management, to get a line on business conditions by direct contact with the representatives, and to demonstrate to the men the new machines recently added to the Heald line.

Business sessions were held morning and afternoon, at which the executives of the company addressed the men with reference to the business of the past year, and prospects for the future. Individual problems of the men and their relations to the company were discussed and a general plan of campaign mapped out for the ensuing year and covering all sales problems.

The intervening periods were taken up with tours of inspection about the plant and in detailed study of the construction and capabilities of the new machines. The machines were run under test upon regular commercial work in order that the men might become thoroughly familiar with the set-up and operation of them and thus be in position to advise prospective customers as to what to expect in the way of output.

Recommendations for Education of Engineers

A closer co-operation between schools and colleges of engineering, and the industries which depend on them for educational support, was the recommendation made by the committee on Commercial Engineering of the United States Bureau of Education. The committee held its second conference in the Carnegie Institute of Technology, Pittsburgh, Pa., on May 1 and 2. Three group sessions were held. The first was presided over by George W. Dowrie, dean of the school of business, University of Minnesota; the second by Fred M. Feiker, vice-president of the McGraw-Hill Co., Inc.; and the third by L. W. Wallace, executive secretary of the Federated American Engineering Societies. At the close of the discussion the conference adopted the following report:

"The Conference recommends that colleges of engineering and of business adopt the following procedure in developing business training of engineers and the engineering training of business men;

(a) Secure the co-operation of industry in defining standard terminology and specifications of the requirements of industry.

(b) Analyze the specifications of the requirements of industry to determine what are the fundamentals that must be taught, and organize the instruction accordingly.

(c) Study and experiment with ways and means of discovering native bent and of measuring proficiency, that every student may be guided into a career of maximum achievement.

Business Items

The control of the Republic Truck Co., Cleveland, Ohio, has been acquired by J. O. Eaton and a group of associates, who will operate the factory. The transaction includes the control of the Torbensen Axle Co., also of Cleveland.

The New York office of Etablissments Horstmann, of Paris, France, has been discontinued.

Metal & Thermit Corporation, New York, announces the removal of its Pittsburgh branch office from 1427 Western Ave., to 801-807 Hillsboro St., Corliss Station, Pittsburgh.

The Steel Tank and Pipe Co., capitalized at $250,000 has filed articles of incorporation with the county clerk at Oakland, Cal., and will do a general business in steel, iron and other metal products. Directors are: C. H. Ramsden, 709 Santa Ray Ave., Oakland; W. F. Focha, Piedmont, Cal.; and Claire A. P. Duffie.

Perrine & Maloney, Railway Exchange Bldg., Chicago, have been appointed to handle the products of the Lancaster Steel Products Co., of Detroit, in the Chicago district. The Maynard French Steel Co., Mercantile Library Bldg., Cincinnati, has been appointed representative in that city.

The Auto Disel Piston Ring Co., New Haven, Conn., has recently been incorporated under the laws of Connecticut, to manufacture and sell piston rings, auto and gas engine accessories and devices. The capital stock of the new concern is $25,000, and the incorporators are: J. E. Megson, Catskill, N. Y.; R. D. Smith, Cleveland, Ohio; L. Austin, New Haven. A meeting will be held shortly and the company will begin production soon.

We have received a copy of the first volume of the "Jasco Driller," house-organ of the James Clark, Jr. Electric Co., Inc., of Louisville, Ky. Mr. Clark, who is president of the company, writes an interesting message to users of portable drills; the paper also contains some useful hints on ordering such drills.

Dwight P. Robinson & Co., New York, has been awarded the contract for the construction of a building to accommodate the American exhibits at the Brazilian Centennial Exposition, to be held in Rio de Janeiro beginning Sept. 7. The building, which will be the "unofficial" exhibit building, will be constructed of American materials as far as possible.

The United States Steel Corporation has started the construction of a tube mill at Gary, Ind., which it is reported will cost $15,000,000. It is expected that the plant will be operating by the end of 1922.

Employees of the Deane plant of the Worthington Pump and Machinery Corporation, Holyoke, Mass., celebrated April 21 the forty-first anniversary of entrance of the manager, Charles L. Newcomb, into the employ of the concern.

The Canton Rim Co., has purchased the plant of the F. R. Fortune Tool Co., at Wooster, Ohio. An addition will be made to the present buildings, increasing the production capacity at least 50 per cent.

The American-LaFrance Fire Engine Co., with manufacturing plants in Elmira and Bloomfield, N. J., has moved its offices in New York City from 250 West 54th St., to the Fisk Building at 57th St. and Broadway.

Shipments from the factory of the Franklin Automobile Co., Syracuse, N. Y., during the first twenty days of April were not only greater than those for last year, but also set up a mark that has not been reached before during the same period in the history of the Franklin car.

The Hammond Steel Co., Syracuse, N. Y., has been sold for $50,000 to the Sizer Steel Co., of Buffalo, N. Y., at a receiver's sale. The new company is to be known as the Syracuse Steel Co., but is to be merged with the buying corporation. The Sizer company produces high-grade steel tubing. The Syracuse plant is to be equipped for the production of smaller tubing than the Buffalo plant of the concern.

The Patterson-Kelly Co., manufacturers of heating apparatus, has removed its New York City office to 101 Park Ave.

The Shanklin Equipment Co., Springfield, Mass., has contracted to supply cars of the London Tramways, Ltd., London, Eng., with their machines for the issuance of zone tickets and automatic adding of the fares collected. Alfred L. Chase, chief mechanic, will go to England to install the device, the first lot of which will be shipped in a few weeks.

The McKeesport plant of the National Tube Co., of Syracuse, N. Y., has resumed operations on a 100 per cent production schedule.

Following the merger of the Hudson Motor Car Co. and the Essex Motors, Inc., into one company under the Hudson name, a production schedule has been arranged calling for 24,000 Hudson automobiles, and 25,000 Essex cars during the year. Plant operations will be at capacity.

Personals

FRANK ADAMS, of the Whitin Machine Works, manufacturers of textile machinery, Whitinsville, Mass., has left for a business trip into Mexico.

WILLIAM FERGUSON, of the Whitin Machine Works, Whitinsville, Mass., left recently for Europe, where he will be engaged in the interests of the company for the next three months. Mr. Ferguson, will journey through France, Italy and Spain.

W. W. BRASIER, has been appointed general manager of hardware sales of the Yale & Towne Manufacturing Co., Stamford, Conn. Mr. Brasier has been with the company since 1906.

ROBERT H. NEWMAN, of Bridgeport, Conn., has been appointed temporary receiver of the Morris Metal Products Co., Bridgeport, Conn.

ROBERT C. MORRIS, of New York City, purchased the assets of the Hartford Automatic Parts Co., Hartford, Conn., at the auction held May 3. The purchase price was $350,000, and it is understood Mr. Morris represented the creditors of the company.

HORACE ARMSTRONG has been appointed sales manager of the Armstrong Bros. Tool Co., Chicago, Ill.

W. M. SHEETS, formerly of the Miami Cycle Works, has been made sales manager of the Lomar Manufacturing Co., Middletown, Ohio. Mr. Sheets is well-known in automotive fields.

L. S. LOVE, formerly vice-president and general manager of Barbour, Love & Woodward, New York, has resigned. No announcement of Mr. Love's plans for the future has been made.

R. M. BARWISE, who for the past twelve years has been the Eeastern representative of the Diamond Chain and Manufacturing Co., Indianapolis, Ind., has opened an office and storeroom at 18 Hudson St., New York City. Mr. Barwise will be a distributor for Diamond block and roller chains, custom made sprockets and special chains; also for Philadelphia gears and sprockets.

Obituary

GEORGE M. HOWE, metallurgic expert and author of many books on that subject, died at his home in Bedford Hills, N. J., on May 14. Mr. Howe had been honored by the British Iron and Steel Institute and by Franklin Institute. He was president of the American Institute of Mining Engineers in 1893.

JOHN H. PATTERSON, founder of the National Cash Register Co., Dayton, Ohio, died suddenly on May 7, while enroute to Atlantic City. Mr. Patterson was president and manager of the company which he organized in 1884 and was best known among manufacturers for his industrial philanthropy.

Catalogs Wanted

The Iron City Machine Works, Pueblo, Col., would like to receive catalogs and circulars from manufacturers of iron and steel products, machinery, tools and machine shop equipment. This company recently acquired the plant of the Main Street Machine Shop, in Pueblo.

Forthcoming Meetings

National Association of Office Managers: Annual meeting. Washington, D. C., May 18 to 20. Secretary, F. L. Rowland.

American Society for Steel Treating: Pittsburgh Section meeting, Bureau of Mines Auditorium, Pittsburgh, Pa., May 25 and 26.

American Foundrymen's Association: Annual meeting, Rochester, N. Y., week of June 5. Secretary, C. E. Hoyt, 140 South Dearborn St., Chicago, Ill.

American Railway Association: Section III, Mechanical: Annual meeting, Atlantic City, June 14 to 21. (Formerly the Master Car Builders and the Association of Master Mechanics.)

Society of Automotive Engineers: Summer meeting, White Sulphur Springs, W. Va., June 20 to 24. C. F. Scott, 29 West 39th St., New York City, is chairman of the convention committee.

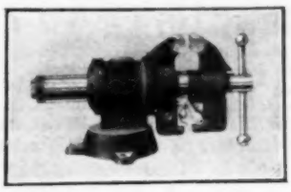
American Society for Testing Materials: Twenty-fifth annual meeting, Chalfonte-Haddon Hall Hotel, Atlantic City, June 26 to July 1. Secretary, C. L. Warwick, 1315 Spruce St., Philadelphia, Pa.

Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

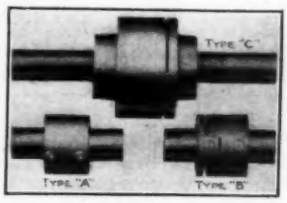
Vise, Machinists', Swiveling Base, "Nutyp"
Atlas Vise Co., Inc., Lowville, N. Y.
"American Machinist," January 26, 1922

The jaws of the vise are 3 in. wide and have an opening of 3½ in. On the opposite side of the screw from the plain jaws is mounted a pair of pipe jaws with a capacity of 1⅛ in. diameter. There is a shearing device for cutting stock ¼ in. in diameter. The jaws can be swung about the axis of the screw and locked in any position. The whole vise can be swung about a vertical axis and locked in position. Weight, 40 pounds.



Couplings, Shaft, Flexible, Bartlett
C. H. Breaker, 4226 Broadway, Indianapolis, Ind.
"American Machinist," January 26, 1922

The flexibility of the coupling is derived from a turning motion around pins, and from a sliding motion in a tongue-and-groove construction. The coupling maintains a uniform angular velocity ratio between the two shafts, no matter what the degree of angular or parallel mis-alignment. End float is also allowed. The coupling is made in three types. Type A has one collar pinned directly to one shaft end. Type B has a collar or ring pinned to each shaft end, connected by a groove and slot. Type C has a hub keyed to the end of each shaft; it is made for heavy service, high torque and high speed.

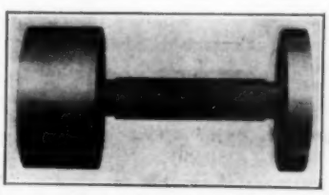


Wrench Set, Socket, Ratchet, H. & G.
Eastern Machine Screw Corporation, New Haven, Conn.
"American Machinist," January 26, 1922

Ten sockets for hexagon nuts from ⅞ to 1 in. in size are provided. A hexagon head is provided on the top of each socket for turning it, all of the wrench parts fitting over this head. An adjustable T-handle is provided. The crossbar in it can be used in a central position for fast work or slid to one side to obtain greater leverage. The ratchet is compact, and may be made either right- or left-hand. An extension piece and a universal joint are furnished. A drop-forged box wrench is included in the set. Each outside part of the wrench attachment has a spring-steel split screw for holding the parts together.

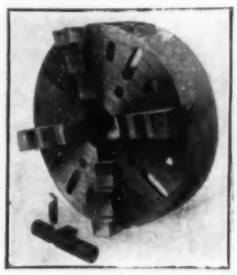
Gages, Plug, Reversible, Large, "Trilock"
Pratt & Whitney Co., Hartford, Conn.
"American Machinist," February 2, 1922

The two gage disks are forced into the ring on a taper before grinding, and grip the central tube. Three prongs on the handle are forced into three grooves in the bushing, providing a three-point, self-centering support. The washer at one end and the handle at the other bear on both the stay-tube and the disks. The gages can be supplied either single- or double-ended, the threaded ones in all sizes above ½ in. and the plain cylindrical gages ⅝ in. and above.



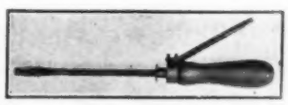
Chuck, Lathe, Steel-Bodied
Cushman Chuck Co., Hartford, Conn.
"American Machinist," January 26, 1922

The chuck is made in sizes from 10 to 30 in. All parts, finished to master gages, are interchangeable. The screws have a greater length of bearing than in the former design. The thrust bearing is made in two parts and completely encircles the screw midway of the screw length. The stem of the thrust bearing is round, is driven into a round hole in the chuck body, and is self aligning. It provides a firm bearing against thrust in either direction. Weight, from 64 to 452 lb., according to size.



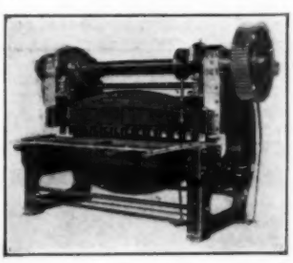
Screwdriver, Lever-Operated, Ratchet
William Roberts, 457 Main St., Springfield, Mass.
"American Machinist," January 26, 1922

By the device, considerable torque may be applied in turning slotted-head screws. The auxiliary handle has a cam-shaped bearing against the shank of the screwdriver. It acts as a ratchet, binds the shank when tightening the screw, and can be operated in either direction. The device is made in several styles, one of which may be attached to and removed from any screwdriver. A split taper collet placed on the shank is clamped by a tapered nut screwed down on it. The ratchet and lever fit on a collar on the collet. The device may be furnished with a hollow head for fitting bolt and socket-wrench heads.



Shear, Gap, Power-Driven
Streine Tool and Manufacturing Co., New Bremen, Ohio.
"American Machinist," February 2, 1922

The machine has a capacity for cutting ½-in. and lighter annealed steel plates, and can be furnished in any size. A 15-hp. motor gives a gear reduction of 16 to 1. The flywheel speed is 280 r.p.m., giving 18 strokes per minute of the cutter bar. The cutter bar or crosshead is of box-type construction. The clamp operates automatically. The machine has front, side and back gages and can be arranged for motor drive. Graduations in sixteenths of an inch are marked from the edges of the shear blades to the ends of the front gage supports. With 6-ft. shear blade: floor space, 84 x 120 in.; height, 88 in.; weight, 18,500 lb.



Horning Press, Motor-Driven
Ferracute Machine Co., Bridgeton, N. J.
"American Machinist," February 2, 1922

The press is driven by an electric motor. The motor shaft carries a raw-hide pinion that meshes with teeth cut in the periphery of the flywheel. The horn hole in the frame is 7½ in. in diameter, and 43 in. from the floor. The horizontal distance from the center of the ram to the front of the frame is 11 in. Guides in the vertical front allow the adjustable bed to be affixed at various heights and square with the bottom of the ram. The press is made in five sizes.

Clip, paste on 3 x 5-in. cards and file as desired

The Weekly Price Guide

Rise and Fall of Market

Advances—Sheets, blue, black and galvanized, New York, are quoted 10c. higher throughout the list, Cleveland and Chicago prices remaining firm. Electrolytic Copper is given a higher price of 13.75c up to carlots, at New York. Linseed oil is firm at 95c. New quotations place open hearth spring steel at 4c.; spring steel at 8c., and coppered bessemer rods at 7c.

Declines—Copper sheets fall to 19.25c. when demand becomes slack. Brass and zinc sheets remain firm.

IRON AND STEEL

PIG IRON — Per gross ton — Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	$21.50
Northern Basic	23.50
Southern Ohio No. 2	25.02
NEW YORK—Tidewater Delivery	
Southern No. 2 (Silicon 2.25 to 2.75)	28.56
BIRMINGHAM	
No. 2 Foundry	17.50
PHILADELPHIA	
Eastern Pa., No. 2x, 2.25-2.75 sil	25.40
Virginia No. 2	28.24
Basic	23.50
Grey Forge	24.46
CHICAGO	
No. 2 Foundry local	22.00
No. 2 Foundry, Southern, sil 2.25@2.75	23.92
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	21.30
Basic	23.00
Bessemer	23.96

IRON MACHINERY CASTINGS—In cents per pound:

	Light	Medium	Heavy
Pittsburgh	9.0	6.0	3.0
Philadelphia	8.5	5.0	3.0
Atlanta	5.5	4.5	4.0
Detroit	7.0	4.5	3.0
Birmingham	12.0	6.5	3.0
Denver	8.0	6.0	5.0
New Orleans	6.0	4.5	3.5
Minneapolis	9.0	6.0	4.5
New York	9@10	6.0	3.0
Cincinnati	6.0	5.0	4.5
Cleveland	6.75	4.5	2 6
Chicago	5.0	4.5	3.5

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	New York	Cleveland	Chicago
No. 10	2.40	3.48	3.15	3.38
No. 12	2.45	3.53	3.20	3.43
No. 14	2.50	3.58	3.25	3.48
No. 16	2.70	3.68	3.35	3.58
Black				
Nos. 17 and 21.	3.00	4.15	3.55	4.10
Nos. 22 and 24.	3.05	4.20	3.60	4.15
Nos. 25 and 26.	3.10	4.25	3.65	4.20
No. 28	3.15	4.35	3.90	4.30
Galvanized steel sheets:				
Nos. 10 and 11.	3.15	4.35	3.75	4.30
Nos. 12 and 14.	3.25	4.45	3.85	4.40
Nos. 17 and 21.	3.55	4.75	4.15	4.70
Nos. 22 and 24.	3.70	4.90	4.45	4.85
No. 26	3.85	5.05	4.60	5.00
No. 28	4.15	5.35	4.90	5.30

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the latest Pittsburgh basing card:

Steel Inches	Black	Galv.	Iron Inches	Black	Galv.
		BUTT WELD			
1 to 3	71	58½	¾ to 1¼	44½	29½
		LAP WELD			
2	64	51½	2	39½	25½
2½ to 6	68	55½	2½ to 4	42½	29½
7 to 8	65	51½	4½ to 6	42½	29½
9 to 12	64	50½	7 to 12	40½	27½
		BUTT WELD, EXTRA STRONG, PLAIN ENDS			
1 to 1¼	69	57½	¾ to 1¼	44½	30½
2 to 3	70	58½			
		LAP WELD, EXTRA STRONG, PLAIN ENDS			
2	62	50½	2	40½	27½
2½ to 4	66	54½	2½ to 4	43½	31½
4½ to 6	65	53½	4½ to 6	42½	30½
7 to 8	61	47½	7 to 8	35½	23½
9 to 12	55	41½	9 to 12	30½	18½

Malleable fittings. Classes B and C, Banded, from New York stock sell at net list. Cast iron, standard sizes, 20–5% off.

WROUGHT PIPE—Warehouse discounts as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in. steel butt welded	66%	53%	60½%	47½%	62½%	48½%
2½ to 6 in. steel lap welded	61%	47%	58½%	44½%	59½%	45½%

Malleable fittings. Classes B and C, Banded, from New York stock sell at list less 10%. Cast iron, standard sizes, 32–5% off.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (base)	4.00	6.00	4.50
Spring steel (light) (base)	8.00	6.00	6.00
Coppered Bessemer rods (base)	7.00	8.00	6.03
Hoop steel	3.38	2.81	3.13
Cold rolled strip steel	6.25	8.25	6.35
Floor plates	4.70	4.66	4.98
Cold finished shafting or screw	3.35	3.00	3.30
Cold finished flats, squares	3.85	3.50	3.80
Structural shapes (base)	2.58	2.41	2.38
Soft steel bars (base)	2.48	2.31	2.28
Soft steel bar shapes (base)	2.48	2.31	2.28
Soft steel bands (base)	2.98	....	2.88
Tank plates (base)	2.58	2.41	2.38
Bar iron (2.00@2.10 at mill)	2.48	2.21	2.28
Drill rod (from list)	55@60%	55%	50%
Electric welding wire:			
3/32	8.00		12@13
1/8	6.50		11@12
5/32 to 1/4	6.25		10@11

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York	13.75
Tin, 5-ton lots, New York	31.50
Lead (up to carlots), St. Louis, 5.40; New York	5.75
Zinc (up to carlots), St. Louis, 5.27½; New York	5.62½

	New York	Cleveland	Chicago
Aluminum, 98 to 99% ingots, 1-15 ton lots	19.20	20.00	18.00
Antimony (Chinese), ton spot	5.50	6.75	6.25
Copper sheets, base	19.25	19.50	23.00
Copper wire (carlots)	14@14.25	16.00	16.25
Copper rods (ton lots)	17.75	21.00	19.50
Copper tubing (100-lb. lots)	20.75	22.50	23.00
Brass sheets (100-lb. lots)	15.75	17.00	18.75
Brass tubing (100-lb. lots)	18.00	18.50	20.50

—Shop Materials and Supplies

METALS—Continued

Brass rods (1,000-lb. lots)	13.75	15.00	15.75
Brass wire (carlots)	16.25	17.75	.....
Zinc sheets (casks)	8.00	17.25	15.75
Nickel (ingot and shot), Bayonne, N. J.	36.00	.....	.....
Nickel (electrolytic), Bayonne, N. J.	39.00	.....	....
Solder (½ and ½), (caselots)	23.00	22.00	19.00
Babbitt metal (fair grade)	30.80	39.50	36.00
Babbitt metal (commercial)	15.50	13.50	9.00

SPECIAL NICKEL AND ALLOYS—Price in cents per lb.

Malleable nickel ingots	45
Malleable nickel sheet bars	47
Hot rolled rods, Grades "A" and "C" (base)	50
Cold drawn rods, Grades "A" and "C" (base)	60
Copper nickel ingots	37
Hot rolled copper nickel rods (base)	45
Manganese nickel hot rolled (base) rods "D"—low manganese	54
Manganese nickel hot rolled (base) rods "D"—high manganese	57

Base price of monel metal in cents per lb., f.o.b. Bayonne, N. J.:

Shot	32.00	Hot rolled machined rods (base)	48.00
Blocks	32.00	Hot rolled rods (base)	40.00
Ingots	38.00	Cold drawn rods (base)	50.00
Sheet bars	40.00	Hot rolled sheets (base)	45.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	10.00	11.75	10.25
Copper, heavy, and wire	9.50	10.75	9.25
Copper, light, and bottoms	8.50	9.00	8.25
Lead, heavy	3.75	4.50	3.65
Lead, tea	2.75	3.25	3.00
Brass, heavy	5.75	6.00	8.00
Brass, light	4.25	4.50	4.75
No. 1 yellow brass turnings	5.00	5.50	5.00
Zinc	2.75	2.50	2.50

TIN PLATES—American Charcoal Plates—Bright—Cents per lb.

		New York	Cleveland	Chicago
"AAA" Charcoal Melyn Grade:				
IC,	20x28, 112 sheets	20.00	18.25	18.50
IX,	20x28, 112 sheets	23.00	21.00	20.90
"A" Charcoal Allaways Grade:				
IC,	20x28, 112 sheets	17.00	16.00	17.00
IX,	20x28, 112 sheets	20.00	18.75	19.60
Coke Plates, Bright				
Prime, 20x28 in.:				
100-lb.,	112 sheets	12.50	11.00	14.50
IC,	112 sheets	12.80	11.40	14.80
Terne Plate				
Small lots, 8-lb. Coating:				
100-lb.,	14x20	7.00	5.60	7.25
IC,	14x20	7.25	5.85	7.40

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb	$0.07½@$0.10	$0.12	$0.12
Cotton waste, mixed, per lb	.055@.09	.09	.09
Wiping cloths per M., 13¼x13¼	.....	50.00	55.00
Wiping cloths per M., 13¼x20½	.....	55.00	65.00
Sal soda, 100 lb. lots	2.80	2.50	2.65
Roll sulphur, 360 lb. bbl., per 100 lb	2.85	3.25	3.50
Linseed oil, per gal., 5 bbl. lots	.95	.95	1.04
White lead, dry or in oil	100 lb. kegs.	New York, 12.25	
Red lead, dry	100 lb. kegs.	New York, 12.25	
Red lead, in oil	100 lb. kegs.	New York, 13.75	
Fire clay, per 75 lb. bag		.80	1.00
Coke, prompt furnace, Connellsville	per net ton	$3.25@$3.50	
Coke, prompt foundry, Connellsville	per net ton	$4.25@$4.75	

SHOP SUPPLIES

Current Discounts from Standard Lists

	New York	Cleveland	Chicago
Machine Bolts:			
All sizes up to 1x30 in	55%	60–10%	60%
1½ and 1¼x3 in. up to 12 in	40%	60-10-10%	60-10%
With cold punched sq. nuts	40%	.....	....
With hot pressed hex. nuts up to 1x30 in. (plus std. extra of 10%)	45%	.....	$4.00 off
Button head bolts, with hex. nuts	30%	$3.90 net	.....
Hex. head and hex. nut bolts	35%	.....	65-5%
Lag screws, coach screws	55%	.....	60-5%
Square and hex. head cap screws	75—10%	75%	70-10%
Carriage bolts, up to 1 in. x 30 in.	45%	60-10%	50-5%
Bolt ends, with hot pressed nuts	55%	.....	55%
Tap bolts, hex. heads	+10–15%	.....	.....
Semi-finished nuts ⅝ and larger	70%	75–10%	80%
Case-hardened nuts	65%	.....	.....
Washers, cast iron, ½ in., per 100 lb. (net)	$4.50	$3.50	$3.50
Washers, cast iron, ⅜ in. per 100 lb. (net)	3.75	3.50	3.50
Washers, round plate, per 100 lb. Off list	4.00	....	3.50 net
Nuts, hot pressed, sq., per 100 lb. Off list	2.50	3.50	4.00
Nuts, hot pressed, hex., per 100 lb. Off list	2.50	3.50	4.00
Nuts, cold punched, sq., per 100 lb. Off list	2.50	3.50	4.00
Nuts, cold punched, hex., per 100 lb. Off list	2.50	3.50	4.00
Rivets:			
Rivets, 7/16 in. dia. and smaller	60-5%	60-10-10%	60-10%
Rivets, tinned	60-5%	60-10-10%	4½c. net
Button heads ¾-in., ⅝-in., 1x2 in. to 5 in., per 100 lb (net)	$3.70	$3.25	$3.00
Cone heads, ditto (net)	3.80	3.35	3.10
1½ to 1¾-in. long, all diameters, *EXTRA* per 100 lb	0.25	.....	0.15
⅝ in. diameter *EXTRA*	0.15	.....	0.15
½ in. diameter *EXTRA*	0.50	.....	0.50
1 in. long, and shorter *EXTRA*	0.50	.....	0.50
Longer than 5 in *EXTRA*	0.25	.....	0.25
Less than 200 lb *EXTRA*	0.50	.....	0.50
Countersunk heads *EXTRA*	0.35	.....	$3.35 base
Copper rivets	60–5%	50%	50-10%
Copper burs	40%	50%	.....
Lard cutting oil (50 gal. bbl.) per gal.	$0.65	$0.50	$0.67½
Machine oil, lubricating, (50 gal. bbl.) per gal.	0.45	0.35	0.40
Belting—Present discounts from list in fair quantities (½ doz. rolls)			
Leather:			
Light grade	50%	50–5%	60–10%
Medium grade	40–5%	40–10–2½%	50%
Heavy grade	35%	40%	40–5%
Rubber and duck:			
First grade	60–5%	50–10%	40-10%
Second grade	60–10–5%	60–5%	60–5%
Abrasive materials—In sheets 9x11 in.:			
No. 1 grade, per ream of 480 sheets, Flint paper	$5.84	$3.85	$6.48
Emery paper	8.80	11.00	8.80
Emery cloth	27.84	32.75	29.48
Flint cloth, regular weight, width 3½ in., No. 1 grade, per 50 yd. roll,	4.50	.....	4.95
Emery discs, 6 in. dia., No. 1 grade, per 100.			
Paper	1.32	.....	1.49
Cloth	3.02	.....	3.20

New and Enlarged Shops

Machine Tools Wanted

Cal., Los Angeles—The Mission Co., 743 North Main St.—complete line of small machine tools for machine shop.

Col., Pueblo—The Iron City Machine Wks.—catalogues and circulars describing machines, tools and material for use in machine shop.

Ill., Chicago—The Donahue Steel Products Co., 202 North Jefferson St.—one threading machine, 2 in. capacity, 2 spindle; upsetting and forging machines (Ajax) 1¼ in.-2 in. and 5 in.

Kan., Baxter Springs—W. A. Goodwin—drill press, prefer Spider or Armstrong.

Kan., Crestline—C. Brown—power trip hammer, 25 lb. for machine shop.

Kan., Galena—J. F. Byrd, 310 Short St.—power lathe for garage.

Kan., Galena—Outt & Livingston, 217 West 7th St., C. N. Outt, Purch. Agt.—power drill press and lathe.

Mass., Worcester—The G. C. Whitney Co., 67 Union St.—one 6 x 10 in. die stamping press, Waite preferred, (used).

Mich., Detroit—Lamb Co., 1938 Franklin St.—punch presses, No. 2 or No. 3.

Mich., Pontiac—The Nelson-Bordie Trap Co.—two punch presses, one large and one medium.

Mich., Wyandotte — Diamond Spring Bumper Co., manufacturers of automobile bumpers—combination punch and splitting shear for punching ⅝ stock, ½ in. hole.

Mo., Joplin—Belcher & Pettit, 2nd-Joplin Sts.—power lathe, drill press, emery wheel and cylinder grinder for garage.

Mo., Joplin—F. Boyer, East 4th St.—one power lathe.

Mo., Joplin—Cather & Lauderbaugh, 207 Main St., C. Cather, Purch. Agt.—equipment for garage including power lathe and drill press.

Mo., Joplin—F. & P. Garage, 114 Virginia Ave., W. A. Adams, Purch. Agt.—one 40 ton arbor press.

Mo., Joplin—T. S. Maitland, P. O. Box 443 Joplin—power lathe.

Mo., St. Louis—Brown Mchy. Co., 2323 N. 9th St.—coping lathes.

Neb., Lincoln—The Dowling Iron Wks., 204 South 9th St.—punch and shear for structural sections also overhead carrier system.

Neb., Lincoln—The Lincoln Plating Co., 1218 Q St., (sheet metal works), C. F. Moore, owner—cylinder grinder, 18 in. lathe, belting, etc.

Neb., Lincoln—The Taylor Electric Co., 330 South 10th St., F. E. Taylor, Purch. Agt.—lathe, 10 in. swing, 5 ft. bed, bench legs, large spindle and head stock bearing with compound rest and draw in collet.

N. J., Perth Amboy—The Seaboard Refractories Co., Valentines St.—18 in. x 8 ft. lathe.

N. Y., Binghamton—Engbers & Son, 396 Chenango St.—power driven sheet metal working tools including formers, edgers and trimmers.

N. Y., Buffalo—The Natl. Biscuit Co., 217 Ellicott St.—tools and equipment for the repair of auto trucks at garage 213-215 Ellicott St.

N. Y., Buffalo—J. A. Sanders, 115 Lathrop St.—sheet metal working machinery.

N. Y., Charlotte (Rochester P. O.)—H. C. Garrett & Co.—machinery and equipment for small machine shop on Stutson St.

N. Y., Gloversville—H. S. Lawphere, 52 Fremont St., manufacturers of heating, ventilating and sheet metal—sheet metal working tools and equipment, power operated.

N. Y., Jamestown—O. T. Colander, 175 McKinley Ave.—small tools and equipment for proposed garage and repair shop.

N. Y., Jamestown—Jamestown Metal Desk Co., C. H. Dasher, Purch. Agt.—drill presses, punch presses, one lathe, and other small equipment for metal furniture plant.

N. Y., Romulus—The Troutman Garage Co., H. Troutman, Purch. Agt.—complete machinery and tools for motor repair, incl. forge and blower.

O., Columbus—Sulzee Battery & Equipment Co., 296 East Long St., L. E. Sulzee, Secy. and Genl. Mgr.—equipment for auto service including lathe, press and grinder.

O., Columbus—The Columbus Auto Brass Co., 767 North 4th St., T. Ash, Supt.—machinery for repair shop including lathe, shaper, two drill presses and two grinders.

Okla., Hockerville (Kansas P. O.)—The State Line Garage, W. H. Hogen, Purch. Agt.—power lathe, drill press and emery wheel.

Okla., Picher—The Big Four Garage, H. W. Jameson, Purch. Agt.—power lathe.

Okla., Picher—The Tri State Motor Co., A. L. Kinney, Purch. Agt.—power lathe and drill press.

Pa., Canton—The Keystone Garage Co., R. Brann, Purch. Agt.—complete machine tool equipment for service garage and for repairing gasoline motors.

Pa., Carnegie—The Union Tool Co.—one 72 in. vertical boring mill and one 5 ft. radial drill.

Pa., Erie—H. C. Cowley, 1139 East 28th St.—one 14 in. lathe and one small grinder.

Pa., Johnstown—The Cosgrove Coal Co.—horizontal boring mill, 20 in. engine lathe, hexagon turret lathe, centerless grinder, drill grinder, 24 in. shaper, 4-5 ft. radial drill, 2 wheel grinders, 200 ton hydraulic wheel press, Universal milling machine 2 or 3 spindle sensitive drill press, 2 head wheel turning lathe to swing 36 in. Above equipment to be purchased for Cherry Tree Machine Co., Cherry Tree, a subsidiary company.

Pa., Meadville—The Champion Tool Co.—machinery and equipment for new plant on South Main St.

Pa., Pittsburgh—Acme Stamping & Mfg. Co., 207 Corliss St.—one double crank geared press—size 3A, Bliss; one Toggle press, size 3½A Bliss, (used).

Pa., Sharon—The Sharon Pressed Steel Co.—one large die grinder.

Pa., Waynesboro—The Frick Co., Inc., West Main St.—24-26 in. type C Libbey turret lathe, 4½ in. hole through spindle with countershaft; No. 0 Avey high speed ball bearing sensitive drill, ¾ in. spindle, capacity ¾ in. bored for No. 1 Morse taper.

Tenn., Chattanooga—M. B. Parker, 1921 Oak St.—motor driven drill press about 42 in.

Tenn., Knoxville—The Sanford Day Iron Wks.—one double end punch and shear.

Wis., Eau Claire—J. Everson, 311 West Madison St.—equipment for auto repair shop.

Wis., Green Bay—W. J. McGinnis, 338 South Adams St.—equipment for auto repair shop.

Wis., Hartford—The International Stamping Co., c/o A. F. Schauer,—stamping machines.

Wis., Manitowoc—K. O. Muehlberg Co., 209 North 9th St.—equipment and machinery for proposed machine shop on 17th and Franklin Sts.

Wis., Milwaukee—The Arpe Motor & Sales Co., 39th and Fond du Lac Ave., E. A. Arpe, Purch. Agt.—lathe, drill press and two motors.

Wis., Milwaukee—A. Schwope, 557 California St.—drill press and 4 in. machinist's vise.

Ont., Welland—The Lackawanna Tubes, Ltd., F. L. McCallum, Purch. Agt.—lathes, planers, shapers, drill presses and large roll lathes.

Que., Montreal—The Bramon Taxi Service, Phillips Pl., L. Bramon, Purch. Agt.—machinery and equipment for garage.

Machinery Wanted

Col., Colorado Springs—A. J. Kiser, Burns Bldg.—power press for newspaper plant.

Col., Selbert—Settler the Printer, 6 column newspaper press.

Conn., East Norwalk (South Norwalk P. O.)—The Norwalk Mfg. Co., 214 East Ave.—one silk doubling machine, one 64 spindle winding machine and several braiding machines for silk goods.

Fla., Ft. Meade—The Ft. Meade Development Bd., L. A. Morgan, Mgr.—machinery, equipment, etc., for canning plant.

Fla., Wauchula—H. Stansfield—ice manufacturing machinery for cold storage plant, (new or used).

Fla., West Palm Beach—The Palm Fibre Co.—machinery for cleaning fibre, spinning, twisting and balling also for weaving into mats and burlap.

Ill., Chicago—E. M. Heller & Co., 144 West Kinzie St.—one 10 ton York ammonia compressor, with or without condenser and coils; and one single drum, 6,000-lb. hoist, with 3 phase, 60 cycle, 440 volt motor, direct current.

Ill., Chicago—The Royal Auto Body Co., Inc., 3727 Cottage Grove Ave.—cutoff saw and other woodworking machinery.

Ill., Chicago—The Self Adjusting Spring Co., 4925 South Halstead St., A. Allen, Purch. Agt.—additional machinery for the manufacture of automobile springs.

Ill., Chicago—The Western Newspaper Union, 210 South Desplaines St.—Ludlow press, (used).

Ill., Rockford—J. Redin, 1026 Charles St.—one chain hoist.

Ill., Rockford—The Rockford Electric Co., 114 South Wyman St.—condenser and small crane.

Ia., Ft. Dodge—Bd. Educ., P. E. Gustafson, Dir.—will receive bids until May 22 for print shop equipment, woodworking machinery and sheet metal shop equipment for new high school.

Kan., Baxter Springs — The Baxter Springs Herald, P. L. Keener, Purch. Agt.—power newspaper press and job paper cutter for power equipment.

Kan., Baxter Springs—Chanute Smelter Co., D. Peck, Purch. Agt.—belting, shafting, pulleys, hangers, bearings, ore grinders, etc., for new ore concentration mill. Estimated cost $50,000.

Kan., Baxter Springs—F. M. Congdon & Sons, 1323 Park Ave., F. M. Congdon, Purch. Agt.—power band saw.

Kan., Baxter Springs—W. P. Howard—oil drill rig.

Kan., Baxter Springs—J. Keith—power lathe and drill press for blacksmith shop.

Kan., Galena—C. Graham—power lathe for machine shop.

Kan., Galena—The Standard Oil Co., H. C. Porter, Purch. Agt.—oil filtering machinery.

Kan., Galena—M. S. Stillson, 10th St. planing mill—one 10 in. planer and cut off saw for power equipment.

Kan., Nicholasville—The Farmers Dairy Co., c/o J. T. Edwards—machinery and equipment for new dairy.

Kan., Scammon—The Skidmore Pump Co.—crushing machinery and coal crusher.

Ky., Mt. Sterling—The Hon Packing Co., E. T. Hon, Purch. Agt.—machinery and equipment for packing plant.

Ky., Princeton—The Princeton Tobacco Co., Inc., J. Ross, Pres.—machinery and equipment for the manufacture of tobacco products.

Md., Towson—The Baltimore Printing & Bindery Co.—stereotyping outfit and printing equipment.

Mass., Taunton—The H. J. Collis Co., manufacturer of athletic and sporting goods, etc.—two rivet machines, tubular rivet and stud machines that can be used for attaching ice skates on skating shoes, (used).

Mass., West Stoughton—French & Ward, manufacturer of worsted and woolen goods—stretching machine for 40 in. and up heavy fabric material, (used).

Mich., Cadillac—D. Catts, printer—sawing equipment for sawing metal by power; mailer and 10 x 15 Gordon Press.

Mich., Detroit—A. T. Tubbs, 5233 Tillman Ave.—one 8 in. sticker, one tennon machine and one sander.

Mich., Wyandotte—The All Metal Products Co., Labadie St.—one wood band resaw for machine shop.

Minn., Princeton—The Princeton Co-operative Creamery Assn.—power machinery and equipment for new creamery.

Mo., Butler—The Higley Printing Co.—10 x 15 job printing power press for motor equipment.

Mo., Joplin—J. Bangher, 715 Virginia Ave.—power combination planer and a band saw, Sidney machine preferred.

Mo., Joplin—The Braeckels Planing Mill, 1201-1203 Wall St., M. J. Braeckel, Purch. Agt.—Morgan camera lock—corner machine for power machinery.

Mo., Joplin—W. T. Hadley, 817 Main St., mining machinery—2 switches, one Y, 16-20 lb. rails, belt driven hoist, 20 sets wheels and axels, 36 in. gauge, 20 set 12-16 in. wheels, 60 hp. fire box boiler, 40 hp. steam engine, 800 ft. belting and shafting.

Mo., Joplin—Joplin Pleating & Button Mfg. Co., 721 Main St., H. T. James, Purch. Agt.—one cutting and one clinching machine for power equipment.

Mo., Joplin—Joplin Overall Co., 2nd and Joplin Sts.—belting, shafting, sewing machine and cloth cutter for power factory.

Mo., Joplin—The Ozark Magazine, 820 Pearl St., L. J. Mane, Purch. Agt.—power folding and power stapling machines.

Mo., Joplin—Shafer-Cave Creamery Co., 13th and Main Sts., C. C. Shafer, Purch. Agt.—creamery equipment including belting, shafting, hangers, pulleys, and other supplies. Estimated cost $5,000.

Mo., St. Louis—R. W. Baskeville, 2316 Walnut Street—Printing press.

Mo., St. Louis—The Campbell Printing Co., 206 Oliver St.—power 26 in. paper cutter for job printing work.

Mo., St. Louis—The Censor Co., Suite 1273 Arcade Bldg.—equipment for a daily newspaper plant.

Mo., St. Louis—Downing & Co., 405 Equitable Bldg.—one power buffer and one grinding machine.

Neb., College View—G. W. Hudson, shoe repair shop—welt roller, stitching impression machine and crow nailer.

Neb., Lincoln—Graham Printing Co., 118 South 15th St., C. H. Graham, Purch. Agt.—one 12 x 18 printing press and a 26 inch hand cutter.

Neb., Lincoln—The Shamp Filling Station, 13th and High Sts., C. E. Shamp, Purch. Agt.—small compressor.

N. Y., Adams Center—W. Alexander, Main St.—swing cut off saw and table, also shingle making machinery.

N. Y., Binghamton—Binghamton Limestone Co.—complete equipment for saw mill and grist mill.

N. Y., Brooklyn—L. Mundet & Son, 65 South 11th St.—mixing machine, Day preferred.

N. Y., Buffalo—W. Hill, 134 Claremont Ave.—machinery for manufacturing auto parts, proposed factory at 2211 Elmwood Ave.

N. Y., Buffalo—The Martha Washington Laundry, 1468 Main St.—laundry machinery and equipment for proposed building at 1462 Main St.

N. Y., Buffalo—H. Wolcott, 3042 Main St.—charging machinery for small shop to be erected on Main St.

N. Y., Cohoes—F. Gilbert Paper Co., Saratoga and Spring Sts.—wood pulp grinding machinery (3 or 4 pocket grinders).

N. Y., Croghan—The Adirondack Garment Co., F. J. Nortz, Purch. Agt.—shafting, pulleys, transmission equipment and dye house machinery.

N. Y., Edwards—The Northern Ore Co.—electric haulage equipment for underground mine material transportation.

N. Y., Franklinville—The Ontario Cutlery Co., Inc.—machinery and equipment for proposed cutlery plant.

N. Y., Gouverneur—The Gouverneur Limestone Co., H. H. Hodgkin, Purch. Agt.—electrically operated stone saw.

N. Y., Long Island City—The Manhattan Box Co., Nelson Ave.—lifting truck and platform.

N. Y., Massena—The Northern Coca Cola Bottling Wks., F. Pellagrina, Purch. Agt.—bottle filling, washing and capping machinery.

N. Y., Newark—Phillips-Werth Optical Co., Willow Ave. and Main St.—machinery for proposed optical factory.

N. Y., New York—Drydock Fixtures, 359 Bowery—combination saw table with borer attachment, a.c. motor.

N. Y., New York—The Liberty Dry Dock & Repair Co., 16 Bridge St.—hoisting engine, upright boiler, air compressor and stiffleg.

N. Y., New York—The Logan Constr. Co., 15 Park Row—compressor, single stage, horizontal, about 125 ft. long.

N. Y., North Collins—The Auto Steamulator Co., Inc., c/o F. A. Diadato—machinery and equipment for the manufacture of engines, etc.

N. Y., Ogdensburg—E. J. Boyer, Natl. Bank—machinery and equipment for the manufacture of metal curtain rods.

N. Y., Olean—The Acme Milling Co., Inc.—machinery and equipment for new feed mill at Allegany.

N. Y., Oneida—The Van Wheel Corp.—woodworking machinery and equipment.

N. Y., Phelps—The Phelps Fruit Growers Assn.—machinery for proposed fruit packing plant on Ontario St.

N. Y., Rochester—The Empire Welding Wks., 1387 Dewey Ave., C. G. Zimmerman, Purch. Agt.—acetylene welding, brazing and cutting tools and equipment for shop.

N. Y., Rochester—B. Kovalski, c/o Weiss-Knopf Clothing Co.—machinery and equipment for proposed clothing factory at Williamson.

N. Y., Rochester—The Northeast Electric Co., 348 Whitney St.—No. 10 American variety saw table, (new or used).

N, Y., Sackets Harbor—C. Gamble Co., Ambrose St.—double surface planer and electric sanding machine.

N. Y., Schenectady—Mary Ann Creek Mining Co. Inc., 469 State St., W. F. Wellman, Purch. Agt.—Ball (or equal) fine grinding machines, cyanide oil flotation eqiupment, rock drills, air compressors and rock handling equipment.

N. Y., Sherman—D. M. Bockcock—tinsmithing tools for new plant.

N. Y., Syracuse—Hayes & Whitbread Foundry, 136 Richmond Ave.—machinery and equipment for foundry.

N. Y., Watertown—F. A. Jessine, 870 Arsenal St.—special machinery for the manufacture of hair clippers.

N. Y., Watertown—The Wright Bros. Co., 518 Mohawk St., C. Wright, Purch. Agt.—machinery and equipment for splitting, curing, tanning, cutting and pressing leather, also all machinery for the manufacture of leather.

N. C., Akron—The General Stone Co.—rotary crusher for limestone.

N. C., High Point—The Ellison Furniture Co., C. H. Ellison, Secy.—several mortising machines, (used).

N. C., Raleigh—J. D. Whitaker, 220 E. Park Dr.—one double drum hoisting engine and one boiler, about 15 horse power, in good condition, (used).

N. C., Warsaw—E. B. Hinman, box manufacturing machinery for the manufacture of boxes, barrels, etc., (new or used).

O., Cleveland—The Kirk-Latty Co., 1971 West 85th St., S. D. Latty, Pres.—coal and ash conveying machinery, also two 150 hp. and 60 hp. water tube boilers and two 150 hp. stokers.

O., Cleveland—C. J. Pfeil Co., 1976 West 3rd St.—additional machinery for woodworking plant addition.

O., Columbus—Continental Clay Co., Ferris Bldg., C. E. Berridge, Secy. & Treas.—dryer and other brickmaking machinery for plant No. 2, at East Greenville.

O., Columbus—Franklin Brick & Tile Co., Ferris Bldg., R. S. Dingledine, Secy. and Treas.—continuous kiln equipment.

O., Columbus—E. A. Prentice Lumber Co., Vine and Armstrong Sts., E. A. Prentice, Pres.—several kinds woodworking machines.

O., Piqua—W. R. Howe, 618 North Wayne St.—five automatic knitting machines, 20, 24, 26 and 28 in. needle bed, 12 cut, Dubied, Lamd, or Grosser make, (used).

Okla., Apache—J. C. Nagel (Apache Review)—power press for newspaper plant.

Okla., Chickasha—The Daily Express, G. Evans, Purch. Agt.—linotype and other newspaper equipment.

Okla., Hockerville—The Blue Ribbon Mining Co., H. Hawkens, Purch. Agt.—shafting, pulleys, belting and rock crushers for concentration zinc mill.

Okla., Picher—The Picher Planing Mill, H. A. Brocksmith, Purch. Agt.—complete line of planing mill equipment, including power planer, band saw, and sander for plant at Baxter Springs, Kan.

Okla., Picher—The Picher Times, E. E. Sanders, Purch. Agt.—newspaper cylinder press and job press for power equipment.

Okla., Tulsa—The North American Car Co. (manufacturer of railroad cars)—air compressor and motor.

Pa., Erie—W. Blesser, 142 East 12th St.—good size air compressor.

Pa., Marienville—The Marienville Glass Plant—machinery and equipment for proposed glass plant.

Pa., Phila.—The City—ash and coal handling equipment for Queen's Lane plant. Estimated cost, $25,000.

Pa., Phila.—The Pooley Furniture Co., Inc., 17th and Indiana Sts., M. Pooley, Purch. Agt.—36 in. band saw for power machinery.

Pa., Pittsburgh—Pittsburgh Reinforced Brazing & Machine Wks., 2525 Liberty Ave.—two 10 ton cranes.

Pa., Sharon—The Sharon Furniture Mfg. Co., J. Canteloupe, Vice Pres.—full machinery and equipment for furniture manufacturing.

S. C., St. George—The County Record Co., W. S. Stoke, Mgr.—equipment for small newspaper plant, also job printing press, (new or used).

S. C., Union—The Bailey Undertaking Co., T. E. Bailey, Pres.—light woodworking machinery for making caskets, such as rip and cutoff saws, scroll saws, jointers, sanders, tenoners, and small oil burning boiler (new or used).

Tenn., Knoxville—The Appalachian Marble Co., Inc., Marblebrooke Park—300-500 cu. ft. capacity, motor driven, air compressor.

Tenn., Knoxville—The White Oak Corp., H. T. Spencer, Pres.—complete woodworking machinery, metal working lathe, shaper or planer, radial drill, power hack saw and oxy-acetylene cutting and welding outfit.

W. Va., Beckley—The Raleigh Register, (newspaper and job printers), C. Hodel, Purch. Agt.—one 17 in. backing machine.

W. Va., Iaeger—The Pocohontas Red Ash Coal Corp., J. G. McGowan, Mgr.—mining machinery including No. 6 figure 8 incline drum, electric scraper loaders, electric hoists and smaller tools, (new or used).

W. Va., Princeton—The Princeton Bldg. Material Co., Inc., N. J. Jenkins, Genl. Mgr.—single end tennoring machine with copies; hand-feed rip saw or variety saw with expansion mandril; Phillps window frame machine No. 3; glue jointing machine, solid heads; (new or used).

Wis., Glendale—The Glendale Milling Co., J. Slodek, Purch. Agt.—flour mill machinery.

Wis., Manitowoc—A. Fischl Dairy Co., 1421 Marshall St.—ice cream machinery and equipment.

Wis., Merrill—W. Savidusky—complete laundry machinery, belt driven.

Wis., Milwaukee—The Milwaukee Hosiery Co., 520 State St., W. J. Zens, Purch. Agt.—power operated looping machines.

Wis., Milwaukee—The Milwaukee Wet Wash Laundry, 1515 Cherry St., F. Lukuf, Purch. Agt.—laundry machinery, driven by steam power.

Wis., Milwaukee—C. Stolper Cooperage Co., 3300 Fond du Lac Ave., C. Stolper, Purch. Agt.—one saw table complete with gasoline engine.

Wis., Milwaukee—B. A. Weserski, 583 15th Ave., (carpenter and woodworker)—door polishing machine equipped with 2 or 3 drums.

N. B., Frederickton—The Chestnut Canoe Co., J. Walker, Purch. Agt.—sawing, moulding and planing machinery and other equipment.

Ont., London—The International Creamery Co., Detroit, has purchased local abattoir and will install complete equipment for the manufacture of dairy products and ice cream. Estimated cost, $40,000.

Ont., Port Arthur—Richardson & Sons, Ltd., elevator manufacturer, J. Richardson, Purch. Agt.—complete equipment for 1,500,000 bushel elevator.

Ont., St. Williams — McCall Bros. — special wood working machinery for furniture factory.

Ont., Simcoe—The Non Freeze Battery Mfg. Co., R. W. Wallace, Pres.—machinery and special equipment for the manufacture of non freeze batteries.

Ont., Toronto—The Canada Ruler & Novelty Co., W. Hunt, Mgr.—additional woodworking equipment for proposed factory at Galt.

Ont., Welland—The Empire Cotton Co., Ltd., A. D. Payne, Secy.—machinery and equipment for new $250,000 addition to cotton mill here.

Que., Montreal—Millen, Freres, 288 Gouin Blvd. E., manufacturer of sash and doors, J. Millen, Purch. Agt.—complete machinery for planing mill.

Metal Working Shops

Cal., Gilroy—A. Ellis is having plans prepared for the construction of a 1 story garage. Estimated cost, $40,000. W. H. Weeks, 369 Pine St., San Francisco Archt.

Cal., Oakland—The Magnovox Co., 2725 East 14th St., has awarded the contract for the construction of a 2 story, 60 x 200 ft. factory on East 14th St., for the manufactpre of telephones and land speaking devices. Estimated cost, $60,000. Noted May 4.

Cal., Richmond—The Santa Fe Fdry. Co., D and Clinton Sts., has awarded the contract for the construction of a 1 and 3 story foundry on D and Clinton Sts. Estimated cost $100,000. G. W. Penning Mgr.

Cal., San Francisco—The Brumfield Electric Sign Co., 18 7th St., plans to build a 2 story plant for the manufacture of electric signs. Estimated cost, $10,000. Architect not selected.

Cal., San Jose—Temple & Syer, c/o Wolfe & Higgins, Archts., Auzerais Bldg., is having plans prepared for the construction of a 2 story, 96 x 137 ft. garage on 2nd St.

Cal., Stockton—F. A. McCan, c/o David-Heller-Pearce, Archts., Delta Bldg., has awarded the contract for the construction of a 2 story, 75 x 100 ft. garage on California St. Estimated cost, $50,000.

Cal., Vallejo—The Western Die Casting Co., 2927 Newbury St., Berkeley, plans to build a plant here for the manufacture of Winslow carburetors. Estimated cost $45,000.

Col., Pueblo—The Iron City Machine Wks. has acquired the business formerly conducted by the Main St. Machine Shops and plans to improve and enlarge its shop.

Conn., Springdale—The Segal Metal Products Co. will soon receive bids for the construction of 1 story, 40 x 45 ft. foundry and a 3 story, 30 x 120 ft. mahcine shop. Lockwood-Greene Co., 101 Park Ave., New York, Archts. and Engrs.

Conn., Waterbury—The Connecticut Light & Power Co., Lakeville St., will build a 4 story, 60 x 133 ft. garage and storage plant on Freight St. Estimated cost, $100,000. Noted May 11.

Ky., Louisville—H. Madler and M. J. Toule, Selbach Hotel are promoters of a new company which is having plans prepared for the construction of a 4 to 10 story, 150 x 200 ft. garage on 5th and Chestnut Sts. Estimated cost, $250,000. Address J. H. Button Co. 418 West Jefferson St. D. X. Murphy & Bro., 714 Louisville Trust Bldg., Archts.

Mass., Springfield—S. J. Cordner, 22 Taylor St., has awarded the contract for the construction of a 1 story, 60 x 220 ft. garage on North Main St. Estimated cost, $55,000.

Neb., Lincoln—The Dowling Iron Wks., 204 South 9th St., plans to build an addition to its plant, containing 2,500 sq.ft. floor space.

N. J., Hoboken—Fischer-Sweeny Bronze Co., 312 Adams St., will soon receive bids for the construction of a 1 and 2 story, 100 x 200 ft. foundry on 13th and Grand Sts. Estimated cost, $80,000. Lockwood-Greene & Co., 101 Park Ave., New York,, Archts. and Engrs.

N. Y., Binghamton—T. H. Wilbur & Son will build a 1 story, 88 x 96 ft. machine shop at 23-25 Wall St. Estimated cost between $10,000 and 12,000.

N. Y., Buffalo—The Cleveland Cold Drawn Steel Co., 503 Leader News Bldg., Cleveland, O., plans to build a 1 story steel plant along the tracks of the South Buffalo R.R. here. Estimated cost, $1,000,000. C. H. Hopkins, Secy.-Treas. Private plans.,

N. Y., Buffalo—S. Dozeretz, 258 East Ferry St., plans to build a garage and office on Ferry St., E. Estimated cost, $40,000. Architect not announced.

N. Y., Buffalo—McKaig & Hatch, Inc., 1584 Niagara St., plans to build a machine shop on Skillen and Ontario Sts. Estimated cost, $16,000. Architect not announced.

N. Y., Hornell—The Erie R. R., 50 Church St., New York, plans to build an addition to its repair shop here. Estimated cost between $200,000 and $225,000. Address J. Gravis, Hornell, Asst. Div. Engr.

N. Y., New York—The 36th St. Garage Corp., c/o Block & Hesse, Archts., 18 East 41st St., will soon award the contract for the construction of a 3 story, 75 x 100 ft. garage at 103 West 108th St. Estimated cost, $150,000.

O., Cleveland—Alexander Szabo, 1603 Woodward Ave., Lakewood, will soon award the contract for the construction of a 1 story, 40 x 120 ft. garage at 4122 Lorain Ave., here. Estimated cost, $40,000. W. H. Nicklas, 1900 Euclid Ave., Archt.

O., Toledo—J. Ryan has awarded the contract for the construction of a 1 story, 100 x 100 ft. garage and store on 20th and Adams Sts.

Pa., Erie—The Odin Stove Mfg. Co., Inc., is receiving bids for the construction of a 1 story, 26 x 122 ft. stove factory on West 12th St. Estimated cost, $10,500. Architect not announced.

Pa., Phila.—The Central Constr. & Supply Co., 2220 Arch St., will soon receive bids for the construction of a 1 and 2 story, 228 x 350 ft. plant on 53rd and Florence St., for the manufacture of builders and contractors supplies. Estimated cost, $80,000. Private plans.

Pa., Phila.—L. B. Rothchild, Archt., 1225 Sanson St., is receiving bids for the construction of a 5 story, 55 x 160 ft. sales and service station at 1409 North Broad St., for J. J. Greenberg, Morris Bldg. Estimated cost, $200,000. Noted May 4.

Pa., Phila.—C. Zeisloft has awarded the contract for the construction of a 1 story, 100 x 117 ft. garage on Ridge Ave. and Lyceum St. Estimated cost, $60,000. Noted March 2.

Wis., Eau Claire—J. Everson, 311 West Madison St., has awarded the contract for the construction of a 1 story, 50 x 65 ft. garage. Estimated cost, $40,000.

Wis., Green Bay—W. J. McGinnis, 338 South Adams St., has awarded the contract for the construction of a 1 and 2 story, 50 x 95 ft. garage on North Adams St. Estimated cost, $45,000.

Wis., Madison—W. F. Clark, 2105 Keyes Ave., has awarded the contract for the construction of a 1 story, 60 x 186 ft. garage, etc., on University St. Estimated cost, $40,000. Noted May 4.

Wis., Manitowoc—The Hamacheck-Bleser Co., 11th and Franklin Sts., has awarded the contract for the construction of a 1 story, 50 x 139 ft. garage. Estimated cost, $50,000.

Wis., Manitowoc—K. O. Muehlberg, Co., 209 North 9th St., has awarded the contract for the construction of a 2 story, 35 x 70 ft. machine shop on 17th and Franklin Sts. Estimated cost, $45,000.

Wis., Wausau—D. J. Murray Mfg. Co., manufacturer of saw mill machinery, will soon award the contract for the construction of a 1 story, 62 x 228 ft. machine shop. E. C. Hall, 221 Grand Ave., Engr.

Ont., Pt. Colburne—The International Nickle Co. is receiving bids for the construction of a 90 x 140 ft. nickle plant. Architect not announced.

General Manufacturing

Cal., San Francisco—L. R. Lurie, Flatiron Bldg., has awarded the contract for the construction of a 2 story baking oven plant on Howard St. near 4th St. Estimated cost, $11,000. Bake-Rite Oven Mfg. Co., lessee.

Cal., San Jose—J. F. Pyle & Sons, King Rd., have awarded the contract for the construction of a pre-cooling plant on 5th and Lewis Sts. Estimated cost, $7,500.

Cal., San Jose—The Stewart Fruit Co., Wells Fargo Bldg., has awarded the contract for the construction of a 1 story addition to its fruit packing plant on Bassett St. Estimated cost, $5,000.

Conn., Hamden—The Natl. Filter Cloth & Weaving Co., 57 Hope St., Brooklyn, N. Y., has awarded the contract for the construction of a 1 story, 70 x 192 ft. factory on Dixwell Ave. and Mather Sts., here. Estimated cost, $60,000. Noted March 16.

Conn., Hartford—The Capitol City Glass Co., Chapel St., is receiving bids for the construction of a 2 story, 40 x 150 ft. addition to its factory. Estimated cost, $40,000. F. C. Walz, 407 Trumbull St., Archt.

Conn., Norwalk—C. H. Harris, Inc., Main St., has awarded the contract for the construction of a 1 story, addition to glass factory on Main St. Estimated cost, $40,000.

Ind., Fort Wayne—The Craig Biscuit Co., 115 Montgomery St., is having plans prepared for the construction of a 4 story factory. McCormick Co., Inc., 41 Park Row, New York City, Archt. and Engrs.

La., Perryville—J. A. Perry and C. E. McKerson, Monroe, plans to build a carbon and gasoline extraction plant here.

La., Shrewsburg—Armour & Co. plans to build a acid phosphate and fertilizer plant to replace the one which was destroyed by fire. Estimated loss, $200,000. W. E. Turner, Div. Mgr.

Me., Springvale—The Goodall Worsted Co., Sanford, has awarded the contract for the construction of a 5 story, 24 x 280 ft. mill and storehouse. Esimated cost, $700,000.

Mass., Clinton—The Bigelow-Hartford Carpet Co., Thompsonville, Conn., has awarded the contract for the construction of a 1 story, 100 x 275 ft. dyehouse and 4 story, 100 x 114 ft. headhouse. Estimated cost, $250,000. Noted May 4.

Minn., Mankato—The Mankato Co-operative Dairy Assn. has awarded the contract for the construction of a 2 story, 50 x 122 ft. creamery. Estimated cost, $37,419. A. L. Veigel, Mgr. Noted April 27.

N. H., Laconia—Lockwood, Greene & Co., 60 Federal St., Boston, is receiving bids for the construction of a 3 story, 65 x 100 ft. hosiery dyehouse for the Pitman Mfg. Co. Estimated cost, $60,000. Noted April 27.

N. Y., Mt. Vernon—The General Optical Co. has awarded the contract for the construction of a 1 story addition to its plant on Washington St. Estimated cost, $20,000.

N. Y., Phelps—The Phelps Fruit Growers Assn. plans to build a 1 story, 50 x 100 ft. fruit packing plant on Ontario St. Estimated cost between $5,000 and $10,000. Architect not announced.

N. C., Charlotte—The Textile Mill Supply Co., 51 South College St., is having plans prepared for the construction of a 3 story, 140 x 150 ft. mill supply building and warehouse. Estimated cost, $60,000. Lockwood, Greene & Co., Charlotte, Archts.

O., Cleveland—C. J. Pfeil Co., 1976 West 3rd St., has awarded the contract for the construction of a 2 story, 33 x 50 ft. addition to its woodworking factory on West 3rd St. Estimated cost, $40,000.

Pa., Erie—The Erie Metal Furniture Co. has awarded the contract for the construction of a 1 story, 120 x 200 ft. furniture factory. Estimated cost, $65,000. Noted May 4.

Pa., Phila.—The Roosevelt Worsted Co., 20th and Naudain Sts., has awarded the contract for the construction of a 1 and 2 story knitting mill on 20th and Naudain Sts. Estimated cost, $95,000.

Pa., Pittsburgh—The Newspaper Printing Co., Gazette Sq., will soon award the contract for the construction of a 3 story, 81 x 84 x 107 ft. newspaper plant on Gazette Sq. C. B. Lee, Chamber of Commerce Bldg., Archt.

R. I., Shannock—Lockwood, Greene & Co., Archts., and Engrs., 60 Federal St., Boston, are receiving bids for the construction of additions to textile plant, including 1 story, 45 x 100 ft. weave shed, 1 story, 50 x 105 ft. finishing plant and a 1 story, 17 x 45 ft. boiler house, for the Columbia Narrow Fabric Co. Estimated cost, $60,000.

Tenn., Nashville—The Union Ice Cream Co., Broad St., has awarded the contract for the construction of a 3 story ice cream plant on 12th and Broad Sts. Estimated cost, $200,000. Noted March 30.

Wis., Manitowoc—A. Fischl Dairy Co., 1421 Marshall St., has awarded the contract for the construction of a 2 story, 28 x 110 ft. dairy and ice cream factory. Estimated cost, $50,000.

Wis., Marshfield—Blum Bros. Box Co., 135 West 9th St., has awarded the contract for the construction of a 1 and 2 story, 96 x 120 ft. box factory on Main St. Estimated cost, $100,000.

Wis., Milwaukee—R. Gumz & Co., Muskego Ave., has awarded the contract for the construction of a 3 story, 45 x 52 ft. addition to its packing plant on Muskego Ave. Estimated cost, $25,000.

Wyo., Laramie—J. W. Dillon and J. H. Rousch plan to build a factory here for the manufacture of glass specialties, auto lenses, bevel and plate glass, etc. Estimated cost, $180,000.

Ont., Kingston—The Ontario Provincial Government, Dept. of Agriculture, Toronto, will soon receive bids for the construction of a 2 story ice and cheese making plant, here. Estimated cost, $90,000.